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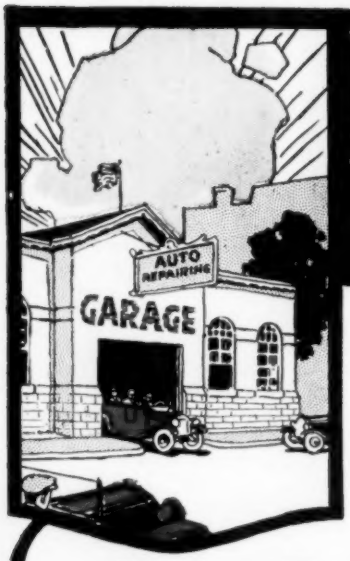
See Page 702



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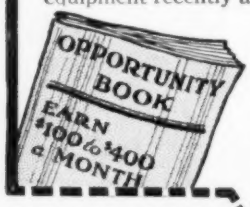

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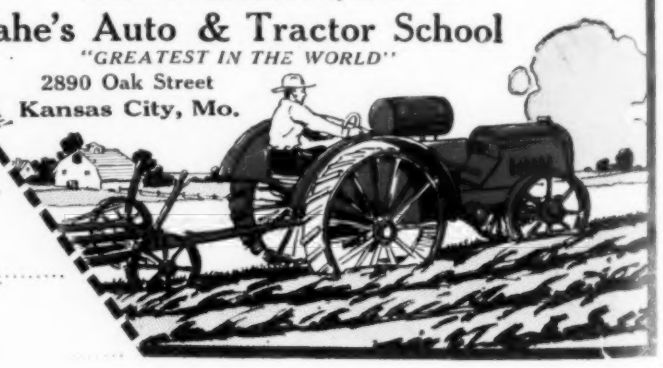

Name.....

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Age.....*Occupation*.....

Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE

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Vol. 31 MAY, 1919 No. 5

Radio Telephones to Report Forest Fires

FIRES in our great national forests are of such serious consequence that fighting them and guarding against them is the chief duty to which the forest rangers devote their lonely lives. From their isolated lookout stations on the mountain peaks to the cabins below, and to the chief ranger's office, stretch the telephone wires that have helped to check many a disastrous fire. But sometimes, when they are most needed, the wires are lying broken and useless under a slide of rocks or snow, or perhaps a fallen tree. So now the rangers are to have wireless telephones, whose functioning cannot be disturbed by any violence of nature. Over the mountain peaks the air is never still; and so upon each lookout station there is to be a windmill, whose air motor will turn

The Windmill Is a New Addition to the Forest Ranger's Lookout Station on Its Mountain Peak at the Left. Its Purpose Is to Drive the Dynamo, Hanging from the Ceiling in the More Intimate View at the Right, That Supplies Current for the Ranger's Wireless Telephone. No Longer can Broken Wires Cut Off the Summons to Fight Forest Fires

Age ..... Occupation .....

the shaft of an electric generator mounted just under the roof. In the room below, two vacuum tubes and the necessary complement of condensers and coils will convert the dynamo current into high-frequency waves, whose telephonic modulations will radiate into space from the surface of short copper-wire antennæ, to be instantly picked up, with their report of "all's well" or their call to vigorous action, at every cabin in the district.

SIMPLE HOLDER FOR PHONE RECEIVER

A sturdy holder for a telephone receiver has been produced which is of some practical value. The quickly adjustable, telescoping arm is hinged to a detachable wooden base, permitting movement of the receiver to any desired position. When conversation is finished a slight inclination of the hinged arm causes a projection to engage with the receiver hook, thus breaking the circuit. Made with a bracket the attachment is adaptable also to wall telephones.

When Not in Use This Telephone Accessory is Pushed Back, Breaking the Circuit as Shown

¶A late addition to the list of fliers downing five or more German planes makes American aces 64 in number.

STONE BRIDGES TORN BY WAR REBUILT WITH CONCRETE

Many of France's old railroad bridges of masonry, destroyed by war, are to be rebuilt with concrete. Lack of timber for constructing centering scaffolds is one reason for adopting the new material. In one reconstruction method already used, the concrete arch was cast in sections in a horizontal mold. These sections, each 15¾ in. wide and 32 ft. 10 in. long, weighed about 22,000 lb. By protecting the arch with a tie-rod and lifting at calculated points, they were transported to the bridge site without difficulty. Concrete keys tied them to the abutments as they were swung into place, 20 sections being used to make the complete arch, which was 26 ft. 3 in. wide with a span of the same dimension. A concrete deck covering the whole structure finished the bridge.

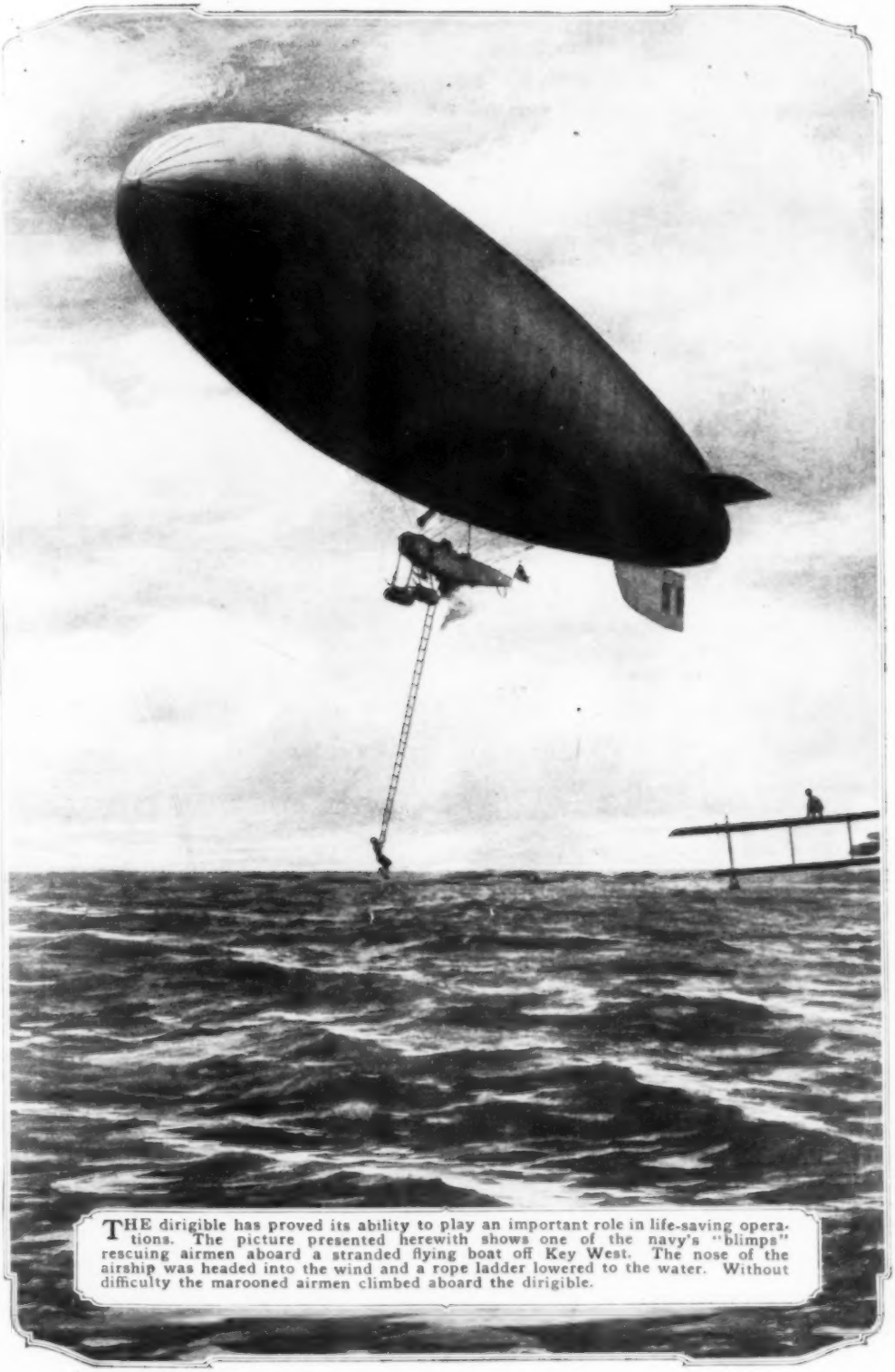
CONCRETE ANCHORS PROVE SERVICEABLE

Concrete anchors are the logical successors to the concrete ship, and seem to be equally practical. Made of reinforced concrete, they are claimed to possess several advantages over the traditional type. Initial cost is very low, making loss of an anchor in a storm a less serious matter than before; and upkeep is practically nothing, since they will not rust nor corrode, and hence never need chipping or painting.

There are two kinds now being manufactured: a slab type, for barges, and a fluke type, used for floating fish traps. Neither looks very acceptable to a sailor, but the latter most nearly resembles the familiar steel anchor, having regulation steel-capped flukes, with edges beveled and surfaces smoothed. These anchors are now being produced in large quantities, in sizes ranging from 500 to 8,000 pounds.

The Concrete Anchors on the Left Are of the Slab Type for Use on Barges. Those on the Right More Nearly Resemble the Familiar Metal-Fluke Type

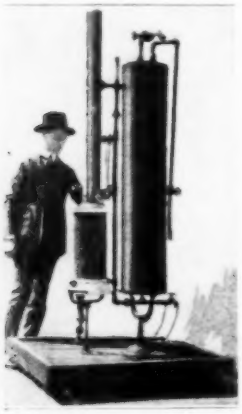
"BLIMP" MAKES SPECTACULAR RESCUE AT SEA



THE dirigible has proved its ability to play an important role in life-saving operations. The picture presented herewith shows one of the navy's "blimps" rescuing airmen aboard a stranded flying boat off Key West. The nose of the airship was headed into the wind and a rope ladder lowered to the water. Without difficulty the marooned airmen climbed aboard the dirigible.

PORTABLE HOT-WATER PLANT SUPPLIES STEAM EFFECTS

Every movie goer is familiar with kitchen-comedy scenes, where hot water and clouds of steam are lavished on the principals. In the past, studio managers have used the household teakettle to secure these effects, but have found it cumbersome and inadequate. To remedy this a prominent film company has improvised an efficient portable hot-water outfit, consisting of an ordinary gas heater and boiler mounted on a movable platform, on which it rolls to various parts of the studio. Numerous gas jets about the plant and a long rubber hose insure a supply of gas whenever needed.



IS THIS THE FIRST YANK TO REACH GERMAN SOIL?

A German photographer has taken the trouble to show us a number of his retreating countrymen. They are evidencing a pardonable interest in what is claimed by a sergeant in a dispatch company with the American army of occupation to be the first American on German territory. The photo was snapped on Nov. 12, 1918, and was purchased by an American soldier with an eye for historical interest, several days later, at a German photo shop.

Beaten Germans on Their "Triumphal" March to Berlin Pause to Inspect an Unconcerned Yank

RADIUM-BEARING ORE SUPPLY STILL ADEQUATE

Reported depletion of American carnotite fields in Colorado and Utah has caused apprehension among refiners of this valuable radium-bearing material. It has been suggested that mesothorium, a by-product of monazite, be substituted for radium both for medical purposes and in the manufacture of luminous materials used on the face of watches and other instrument dials. However, recent investigation seems to disprove the alleged shortage, claiming that 500 grams of radium can still be produced from available carnotite. And against the use of mesothorium it is asserted that it is available only in small quantities, that it must be aged for a year or more before using, and that its short life and varying activity make it undesirable for medical use.

CHINESE OFFICIALS BURN FORTUNE IN OPIUM

Hundreds of cases of opium, reported worth their weight in gold, were lately burned by the Chinese government to prevent the attempted resumption of the trade. From the Shanghai warehouses of the dealers the drug was ferried across the river, under guard, and the sticky mass was fed to four furnaces and carefully raked into the flames. Precautions were taken to make sure that none of the stuff remained, even the rakes being withdrawn only after prolonged burning.

BIRD RECORDS ON PHONOGRAPH BRING UNSAVORY VISITORS

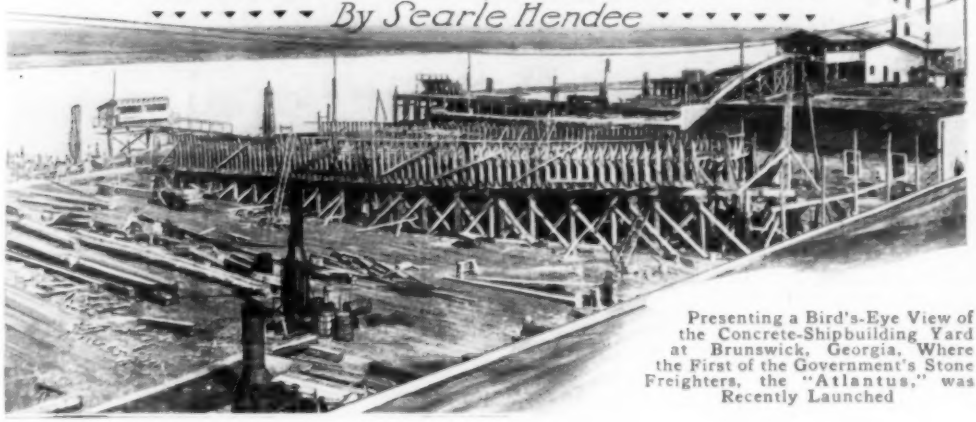
An unintentional parody on the sport of luring seals with phonograph music, as related in the March number of Popular Mechanics, was played in the Michigan woods last summer. In this case, however, the "sport" element was not apparent until time had softened the recollection. A cottager from Chicago, fond of birds, set his phonograph on the bungalow porch to playing records of bird songs. Soon visitors began arriving from the woods — pretty black and white kitties, in ever-increasing numbers. Skunks are very fond of birds' eggs, and not afraid of anything. Naturally the concerts were discontinued.

CONCRETE MERCHANT SHIPS

Will They Drive Steel Vessels from the Sea?

Their Singular Status in the Dark Days of War: Their Chance of Development in Time of Peace

By Searle Hendee

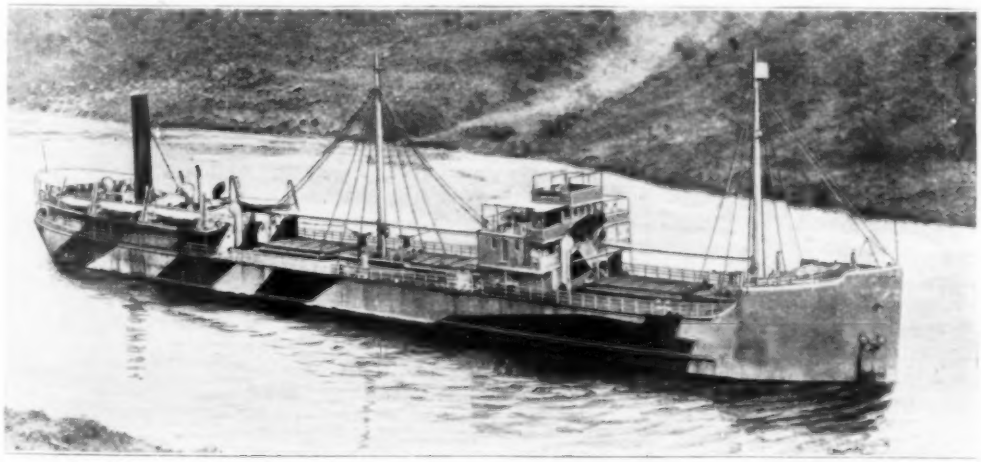


Presenting a Bird's-Eye View of the Concrete-Shipbuilding Yard at Brunswick, Georgia, Where the First of the Government's Stone Freighters, the "Atlantus," was Recently Launched

WAR was the mother of the concrete ship. War is dead and its unweaned offspring an orphan. Peace, before long, will be the foster parent.

A civil, rather than a military, court henceforth has jurisdiction. The fate of the stone ship will be determined on the unsentimental basis of cold dollars and cents. If it can give convincing proof of superior commercial merit, it will be nourished and permitted to develop. Otherwise, it is doomed to a natural and deserved death.

At the outset let it be said, however, that the concrete ship has a "case." To all appearances it has considerably more than a fighting chance for survival and a promising career. Already its seaworthiness, when properly constructed, has been conclusively demonstrated by the commendable performance of the "Faith," and certain other vessels in this and other countries. Furthermore, it has shown itself to be possessed of inherent advantages of recognized value. The factor that will largely govern its peace-time usefulness,



Carrying a General Cargo, the Concrete Ship "Faith" Passing through Gaillard Cut, Panama Canal, en Route from New York to Valparaiso: The Seaworthiness of the Stone Hull has been Conclusively Demonstrated by This Vessel, Which Has Weathered Heavy Storms and Traveled Thousands of Miles during the Past Year

however, will be the measure of ability with which it competes with the steel cargo carrier. If it succeeds in doing this profitably, and there is reason to believe it can, it will have its place in the sun.

Had hostilities been of longer duration, the concrete ship undoubtedly would have risen on the wave of world emergency to a position of war-time importance at least. The armistice was a severe setback to mushroom development. Progress from now on obviously will lack the stimulus of war and depend on the slower-ripening fruits of peace-time pioneering.

Only a few months ago the concrete ship occupied a peculiarly dramatic position. It offered a possible means of turning the tide of war when the Hun was destroying tonnage faster than the allies were building it. The admitted need of new bottoms far exceeded the possible maximum output of our steel and wood shipbuilding yards. It was imperative that we have ships, and more ships. And it mattered not—except perhaps to certain prosperous interests—whether they be of wood, or steel, or concrete, or oilcloth, so long as they were ships capable of immediate production in large numbers and of a type able to carry men, supplies, and food overseas.

The question of the most ideal and commercially profitable ship was not for a second involved. The whole problem was one of increasing tonnage by making use of every resource at our command, and doing so without wheezing and sputtering.

After exhaustive scientific investigation, the United States Bureau of Standards reported that reinforced-concrete ships could be built "structurally equal to any steel ship." Labor, materials, and equipment for their construction were apparently available without interfering with the wood and steel programs.

But what happened? At every turn obstructions were placed in the path of the concrete ship. It was not given a fair chance to demonstrate its worth. When after months of public and congressional hammering, the Shipping Board finally ordered the establishment of five government concrete-shipbuilding yards, counteraction was immediately taken by prohibiting private construction of concrete hulls. Thus all chance of outside development, at a time when independent interests were manifesting enthusiasm and real progress was to be expected, was effectively blocked.

Just as soon as the concrete division completed plans for a 3,500-ton vessel, the Shipping Board condemned the size as uneconomical and, for a time, tabooed its production. Yet contracts for wood and steel ships of the same size continued to be awarded throughout the year. When the public was being told that concrete ships would be built in quantity if only it were possible to obtain propelling machinery for their equipment, manufacturers who offered to provide this self-same propelling machinery were told that none was wanted. When the "Faith" was chartered to the British ministry for carrying a cargo from New York to Liverpool at $150 a ton, its sailing was prohibited. When foreign interests, with $60,000,000 cash in hand, wanted $100,000,000 worth of concrete ships built in America by private constructors, the contract was forbidden by the Shipping Board. As quickly as the armistice was signed, the Shipping Board cut the concrete-ship program from 42 to 14 vessels. At the same instant, however, the public was asked to pay for charging off as a "war loss" $1,000,000,000 for steel ships, many of which had not been built.

Pages upon pages of other significant items might be tabulated. But the war is won. Democracy is no longer at stake. The concrete ship ceases to be of importance except in a possible commercial capacity. Other things than past opposition to its development must be considered if its peace-time possibilities are to be analyzed.

First of all, we are assured by the Bureau of Standards that the concrete ship can be built structurally equal to the steel ship. We have seen the "Faith" pass through severe tropical storms that have sunk other ships, and arrive in perfect condition at New York after completing a 12,000-mile voyage. Stanchness and seaworthiness have been conclusively proved. But what special utility has the concrete vessel that is not already equally provided by the steel ship? What of its cost, its cargo-carrying efficiency, its life, speed, and special features?

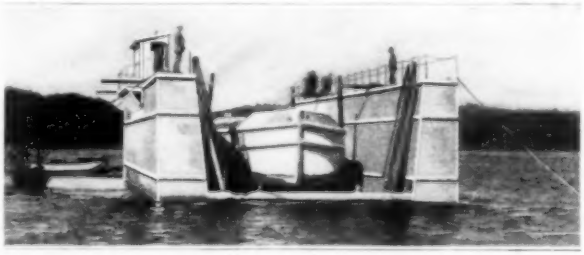
It may surprise some persons to be told that the concrete ship is a bone-dry ship. The "Faith," for instance, has never once used its pumps. It has had no bilge water. The interior of a concrete vessel does not "perspire," as does a steel boat, and it has no leaky seams. This feature adapts it particularly for carrying cargoes that are easily affected by moisture.

Concrete is a nonconductor of heat and cold. In the tropics it has a distinct ad-

The First Reinforced-Concrete Barge Completed for the Government's Use in the New York State Canal, a 150-Foot Vessel with Cargo Capacity of About 500 Tons: Many Concrete Barges Are Now in Use

vantage, for, when exposed for long hours to the intense rays of the sun, it does not become a veritable bake oven. The hull, because of its composition, requires no special protection when cargoes that a steel ship handles with difficulty are carried.

Timber rots and iron corrodes. Concrete improves with age. Insects do not attack it; bacteria, mold, and vermin are not supported by it. Cleaning is easily accomplished, and painting is unnecessary. A ship built of concrete has no maze of seams to be calked. It is monolithic and rivetless. Steel vessels, every two years or so, go into dry dock for thorough cleaning, painting, and overhauling. This expense must be charged to maintenance. The life of a concrete vessel is not a subject of definite knowledge at the present time, but it is a matter of general knowledge that concrete itself has greater permanency than either wood or steel.



There Is Considerable Reason for Expecting That for Some Months to Come Concrete Barges, Lighters, and Car Floats will Be in Greater Demand than Large Concrete Ships. The Picture Herewith Shows a Concrete Barge in a Concrete Floating Dry Dock

The concrete ship is entirely free from the heavy vibrations that make the steel ship tremble from stem to stern. For this reason it offers a distinct advantage as a passenger carrier. In speed it is as fast as, and possibly may be made faster than, other vessels. One reason for this is that it has considerably less skin friction than a ship made of riveted plates. The fire risk is reduced to the minimum. Insurance charges will in all probability be greatly to its advantage because of lower investment of capital. Furthermore, it is asserted that the war proved the concrete ship will remain afloat if torpedoed.

Two items of particular importance are initial cost and upkeep. It has repeatedly been stated by those able to speak with authority, that concrete hulls can be built in quantity for a half or a third the cost of steel hulls of similar dimensions. Cost, however, is an element that has yet to be determined with certainty. The "Faith" offers no data because it was constructed under uneconomical conditions and as a private enterprise. The "Atlantus," the first government-built concrete ship to be

launched, is understood to have been abnormally expensive, apparently due to construction methods, shiftless, inexperienced labor, lack of proper yard facilities, experimentation, and a combination of other circumstances, including its yacht-like design—which incidentally gives conclusive evidence that the lines of a concrete ship may be as graceful as those of a steel craft. Some of the other large vessels in the course of construction at government yards may soon furnish the much-wanted cost information, providing undue plant charges are not levied against them.

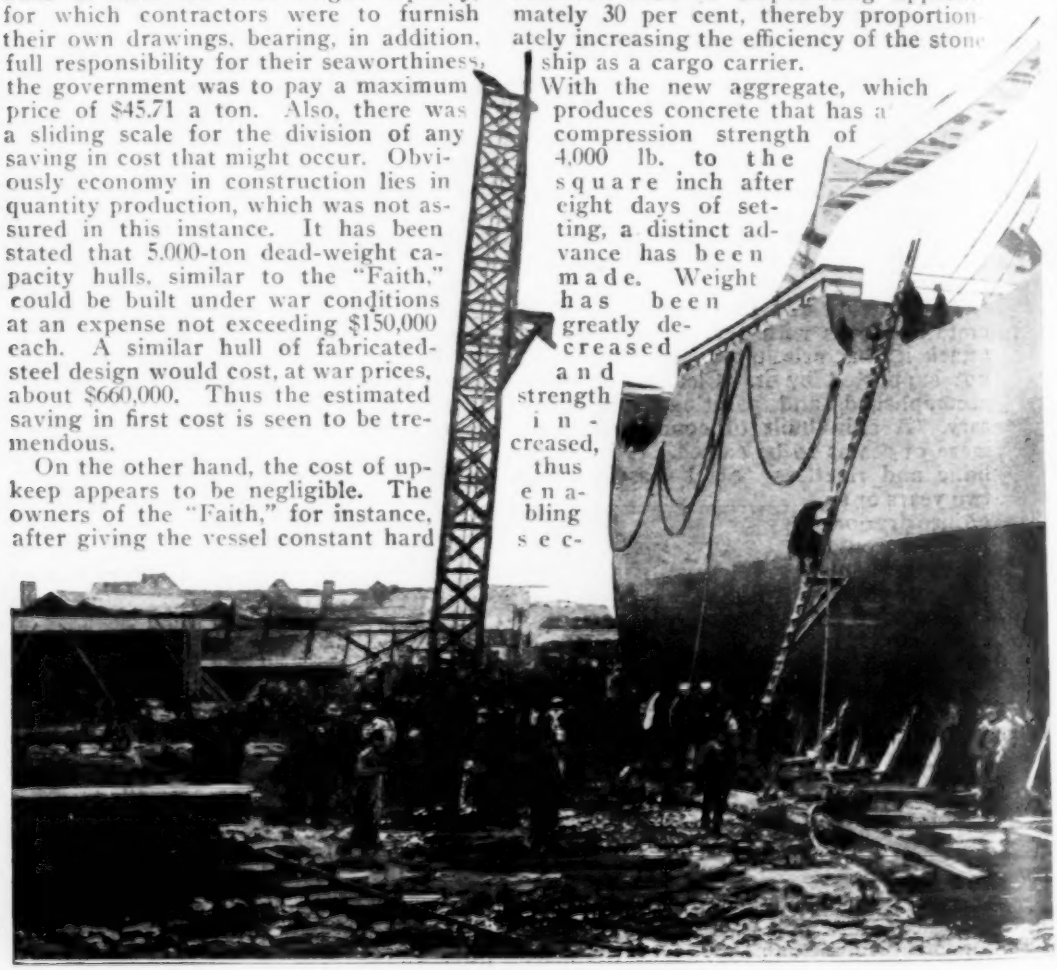
From $30 to $50 a ton has been set by some authorities as a reasonably safe estimate of the actual cost of concrete-hull construction. As further evidence, contracts entered into by the government some months ago might be cited. For hulls of 3,500-ton dead-weight capacity, for which contractors were to furnish their own drawings, bearing, in addition, full responsibility for their seaworthiness, the government was to pay a maximum price of $45.71 a ton. Also, there was a sliding scale for the division of any saving in cost that might occur. Obviously economy in construction lies in quantity production, which was not assured in this instance. It has been stated that 5,000-ton dead-weight capacity hulls, similar to the "Faith," could be built under war conditions at an expense not exceeding $150,000 each. A similar hull of fabricated-steel design would cost, at war prices, about $660,000. Thus the estimated saving in first cost is seen to be tremendous.

On the other hand, the cost of upkeep appears to be negligible. The owners of the "Faith," for instance, after giving the vessel constant hard use for a year, are understood to have charged nothing to this item.

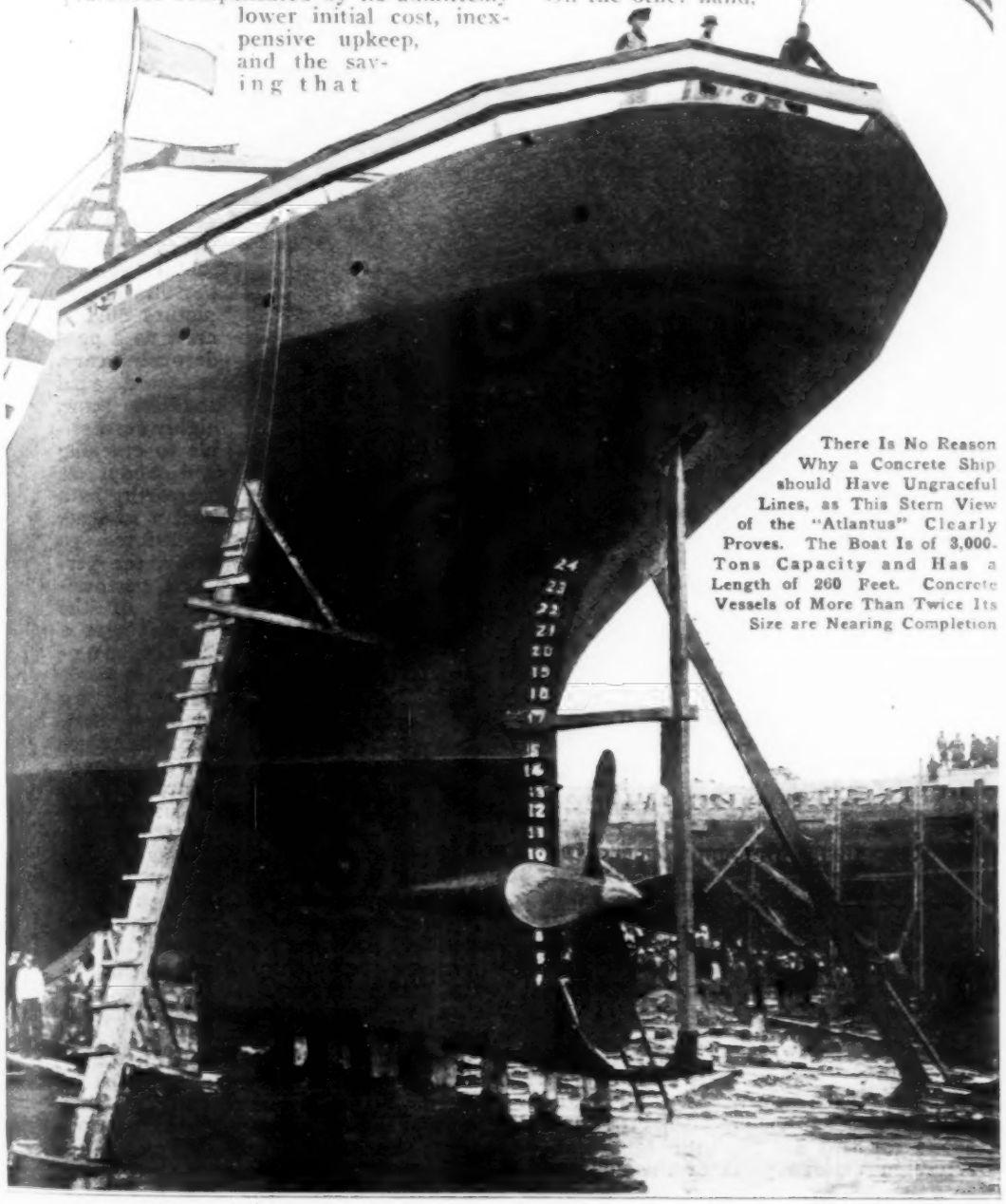
In competition with steel ships on a normal basis, the "Faith" will probably make a poor showing. It was built as an experiment by men unfamiliar with shipbuilding and is a heavy, crude-looking boat, although a most commendable "first attempt." It was built before the new light-weight concrete aggregate was developed, and without the benefit of the scientific work that has of late taught much about such construction. As a result, it in no way represents the ultimate in concrete boatbuilding, nor does it represent the present status of the industry.

The light aggregate, which floats on water, is produced by calcining certain shales or clays to a state approaching fusion. It is used instead of sand and crushed stone and reduces the weight of concrete used in shipbuilding approximately 30 per cent, thereby proportionately increasing the efficiency of the stone ship as a cargo carrier.

With the new aggregate, which produces concrete that has a compression strength of 4,000 lb. to the square inch after eight days of setting, a distinct advance has been made. Weight has been greatly decreased and strength increased, thus enabling sec-



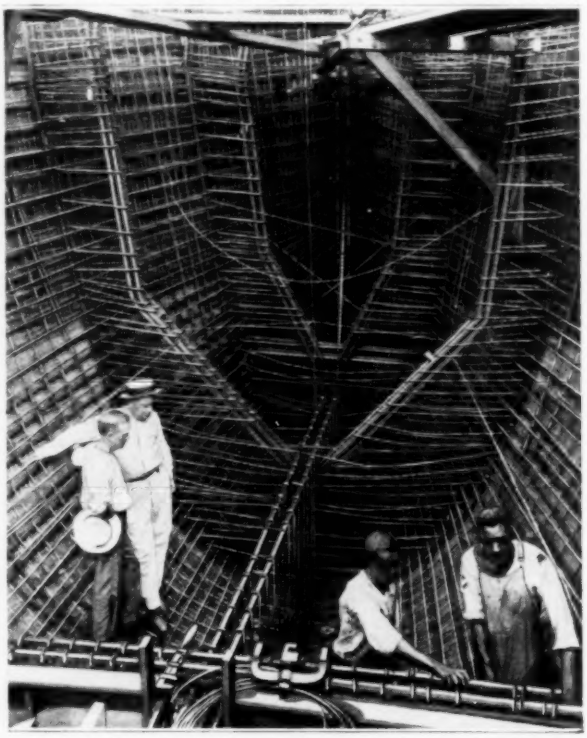
tions to be reduced to practically one-half of what was considered necessary a year ago. Thus, in a few months, the concrete ship has been brought to a state of development that apparently enables it to compete successfully with the steel ship. Its cargo-carrying efficiency is still slightly behind that of its rival of similar size and design, but this disadvantage is to all appearances compensated by its admittedly lower initial cost, inexpensive upkeep, and the saving that will probably accrue through lower insurance rates. The cargo-carrying efficiency of the modern concrete boat of 7,500 tons is placed at 61 or 62 per cent, as compared with 65 or 66 per cent for steel. On the other hand,



There Is No Reason Why a Concrete Ship should Have Ungraceful Lines, as This Stern View of the "Atlantus" Clearly Proves. The Boat Is of 3,000-Tons Capacity and Has a Length of 260 Feet. Concrete Vessels of More Than Twice Its Size are Nearing Completion

designs have been completed for a 14,000-ton concrete ship with an estimated cargo-carrying efficiency of from 70 to 80 per cent! If practice proves that the engineers' calculations are correct, this boat, which is to be of unit construction, should surpass the steel ship in every economic particular. And right here it might be noted that the advent of successful unit construction will overcome the objection now raised because of inability to inspect a concrete hull prior to its completion.

The usefulness of concrete in boatbuilding seems to have practically unlimited range. That is, anything from a 16-ft. launch to a canal barge, and from a 500-ton tanker to vessels of large size, comes within its field. For the Emergency Fleet Corporation, as an example, ten 7,500-ton tankers and freighters, three 3,500-ton and one 3,000-ton freighters are building; for the Navy Department, eight 500-ton lighters; for the Railway Administration, twenty-one 500-ton canal barges, and for the War Transport Branch of the War Department, twelve 225-ft. car floats, five 100-ft. water tankers, and fourteen 130-ft. river boats. On the other hand, a successful concrete rowboat was built in France 70 years ago, and reputable engineers see no reason why a 25,000-ton dead-weight vessel could not be built at present.



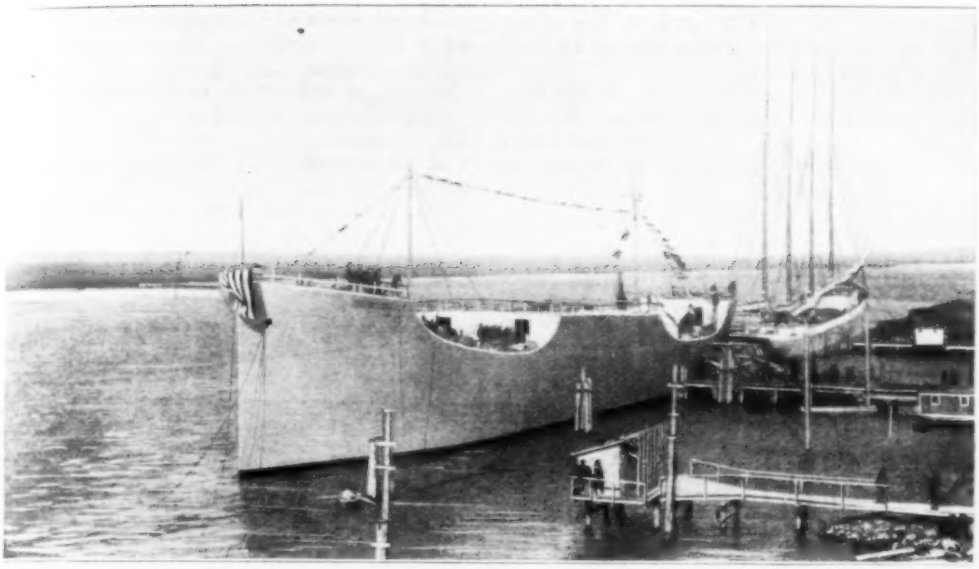
Inside Bow View of the "Atlantus" during Construction, Showing in Detail the Arrangement of the Reinforcing: Experiments of Late have Indicated That Big Advantages Probably Are to be Gained by Welding the Members Instead of Tying Them

It is very possible that the chief immediate demand for concrete vessels will center around barges, lighters, car floats, and other small miscellaneous craft. The reasons for this are that reputable contractors in various parts of the country are capable of constructing them satisfactorily; that they represent comparatively small investments, and that they have already demonstrated their merits. Even a 500-ton barge built of the now obsolete heavy concrete has been able to compete with a 600-ton steel barge of the same dimensions, and has shown practically the same profits.

At the outset, the thought of building a ship of concrete failed to make a particularly favorable impression on the layman, who was wont to think of concrete in terms of cement sidewalks and poorly built stucco houses. It was only natural that the average person should picture such a craft as a ponderously heavy, awkward, and snaillike scow, highly susceptible to cracking and about as seaworthy as a bucket of lead. Therefore, to many, the perfect performance of the "Faith" was a distinct surprise.

Let it be known that, from the structural standpoint at least, the problem of the concrete ship has been solved. Guesswork has not been the guide in its evolution. Concrete engineering is based on exactness, as is every other branch of engineering. Analyses that have never before been made on ships of any type, have contributed scientific data of inestimable value and placed concrete shipbuilding on a sound footing.

For instance, when the "Faith" made its maiden voyage, it carried a new instrument, developed by the Concrete Ship Section of the Emergency Fleet Corporation, for the study of hull stresses. This was the first time in history that stress



Showing How the Government's First Concrete Ship, the "Atlantus," Looks in the Water: The Vessel Is the Smallest of 14 Freighters and Tankers for Which Contracts have been Awarded. It is Expected Soon to be Commissioned

records had been taken on a ship at sea. The instrument, the McMillan "strainagraph," makes a continuous record of deformations, supplying scientific information on which to base improved designs and save materials.

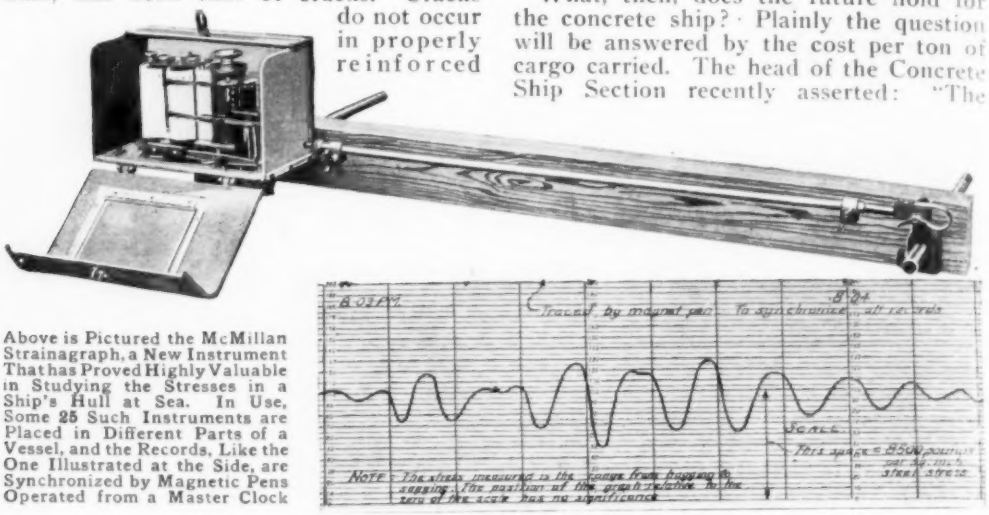
Given the known stresses on one hand, and the known strength of materials on the other, the problem of constructing a concrete ship immediately becomes one of exact calculations. In this connection, it might be mentioned that the reinforcing takes up all of the tension strains that are due to hogging, sagging, twisting, and launching. The concrete itself is depended on for its compression values. It forms the envelope, holds the steel firmly in place, and prevents the bars from buckling.

In the popular mind, concrete is rigid, brittle, easily cracked, and therefore a most unsuitable material for ships. To the contrary, reinforced concrete has considerable elasticity. An eight-inch panel, 20 ft. square, for instance, has been subjected to load and deflected eight inches.

Successful Sailing Vessels, Launches, Tugs, and River Craft have been Built of Reinforced Concrete. This Picture Shows a 40-Foot Boat of a Type Particularly Suited for River and Harbor Use

Upon removal of the load, it has come back to within three-sixteenths of an inch of its original state.

The biggest question of all, to the layman, has been that of cracks. Cracks do not occur in properly reinforced concrete. When they do occur, their appearance is due to lack of proper reinforcing to meet tensional strains. After covering thousands of miles at sea, the hull of the "Faith" was entirely free from breaks except for inconsequential hair cracks. But even in the event of a crack occurring, and water being admitted, no perilous condition would be presented unless the pumps proved inadequate. Some people forget that wooden ships, full of seams, and steel ships, with riveted plates, constantly leak and would sink in time were it not for their pumps. Also, they fail to consider that a crack in a concrete vessel could be mended at sea by filling it with concrete under heavy air pressure.



Above is Pictured the McMillan Strainagraph, a New Instrument That has Proved Highly Valuable in Studying the Stresses in a Ship's Hull at Sea. In Use, Some 25 Such Instruments are Placed in Different Parts of a Vessel, and the Records, Like the One Illustrated at the Side, are Synchronized by Magnetic Pens Operated from a Master Clock

Abrasion has been another thing that has caused uneasiness in the minds of many persons. The hull of the "Faith," however, has shown no sign whatever of wear. Furthermore, a small concrete tug was used throughout the winter of 1917 to break ice and keep the water in front of a certain shipyard open. At the end of the season, examination of the hull showed no indication of abrasion.

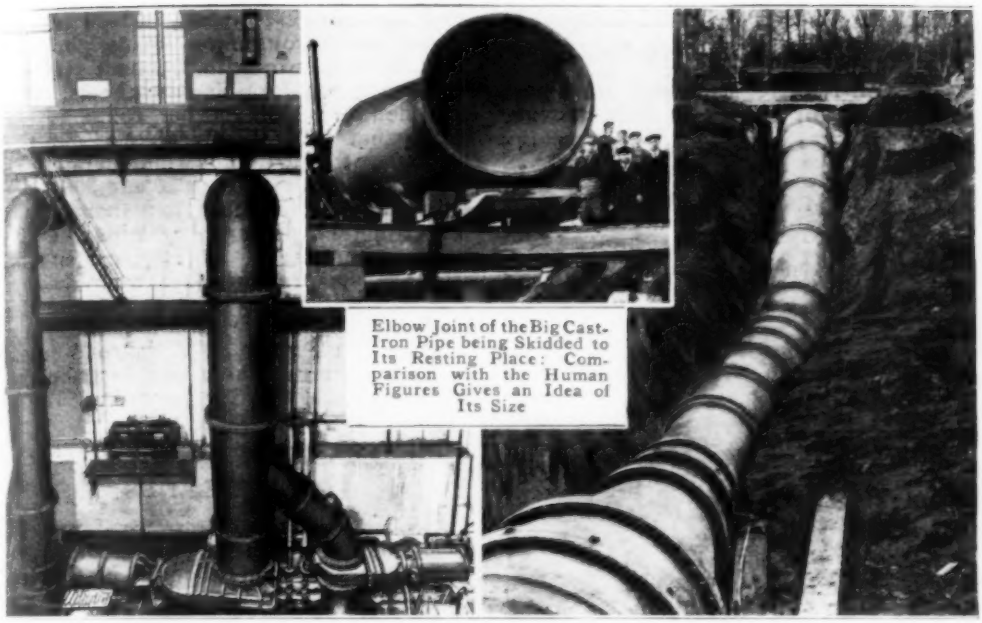
What, then, does the future hold for the concrete ship? Plainly the question will be answered by the cost per ton of cargo carried. The head of the Concrete Ship Section recently asserted: "The concrete ship is economically a success today, if the first cost of the ship is sufficiently less than the first cost of the steel ship that we may write off the decrease in earnings due to the slightly less carrying capacity—and that can be done twice over with the concrete ship as we hope to build it in these tankers [the new 7,500-ton vessels now nearing completion]."

Men who have backed the concrete ship since its birth seem sincere in their belief that eventually it will drive the steel ship from the seas. From the observer's viewpoint, it has an excellent chance of attaining commercial importance, but what it can and will do has as yet to be proved.

Right now the concrete ship faces the same situation that every new enterprise confronts at the outset—the natural hesitancy of capital to invest in a venture that seems to embody speculative elements.

SIX-FOOT CAST-IRON PIPE FOR CITY WATER SUPPLY

Water for the city supply of St. Louis, Mo., is pumped from the Mississippi River into settling basins and then through filtration plants. The Chain of Rocks pumping station has just been improved by the installation of a cast-iron pipe of huge size, which runs 250 ft. to a reservoir with a 60-ft. elevation. The new pipe is six feet in diameter and is the outlet for two pumps whose respective capacity is 110,000,000 and 45,000,000 gal. per 24 hours, making a total of 155,000,000 gal. which the pipe may be called upon to carry in a day. A Venturi meter reducing the diameter from six feet to three feet occupies 50 ft. of the pipe's length.



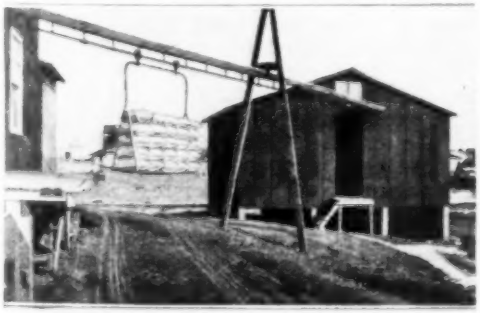
Elbow Joint of the Big Cast-Iron Pipe being Skidded to Its Resting Place: Comparison with the Human Figures Gives an Idea of Its Size

At the Left Is the Pump End of the Six-Foot Pipe, Where It Takes the Output of Two Big Pumps. The Right-Hand Picture Follows the Line of the Huge Conduit in Its Trench. In the Foreground Is the Venturi-Meter Section with Its 54,000 Pounds of Iron

The largest single section cast weighed 23,200 lb. The weight of the entire line was about 440,000 lb., the meter section accounting for approximately 54,000 lb. of this.

AIR-LINE CARRIER SAVES LABOR AT FLOUR MILL

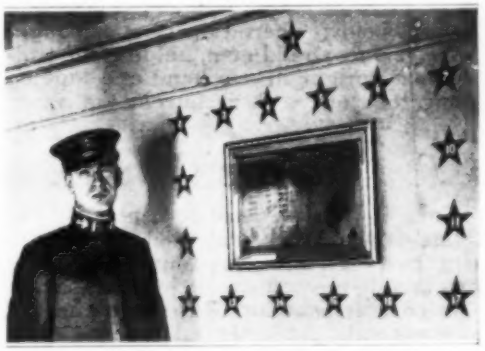
One flour mill has found it easy to speed up efficiency by the simple installation of an overhead track and carrier, conveying the flour from the mill to the warehouse, 50 ft. away. A slight fall to the track pulls a full load of 25 sacks safely to the warehouse. Swivel trucks enable the carrier to turn two 45° bends in its journey.



Gravity Carries Loads of Flour from Mill to Warehouse. Swivel Trucks Enable Carrier to Make Two 45-Degree Turns

STARS ON THIS "SERVICE FLAG" MEAN ENEMY SUBS SUNK

It is a service flag all right, but not at all in the usual sense. The 17 stars

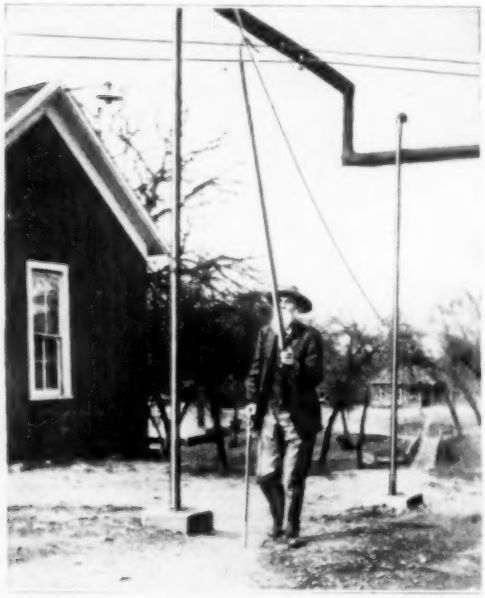


Stars on the Side of the Mine Layer "Quinnebaug's" Cabin Indicate That the Ship's Mines Sunk 17 Enemy Submarines. The Tablet in the Center Lists, Month by Month, a Total of 6,045 Mines Laid

grouped about a tablet on the outside cabin wall of the mine layer "Quinnebaug," recently returned to the Philadelphia navy yard after nearly eight months in the North Sea, are symbols of 17 enemy submarines the ship sunk with its mines. The tablet among the stars lists the number of mines laid each month of its service, 6,045 being the total record.

TROLLEY WIRE FOR BLIND MEN KEEPS THEM "ON THE TRACK"

The wire is there, stretching from post to post like any trolley, and the moving



Trolley System for Guiding the Blinded Veterans of the Confederate Army about the Grounds of a Soldiers' Home in Texas: In the Distance Is One of the "Stations," a Rustic Bower with Comfortable Seats

rod that reaches up to make contact with it. But below, where the street car ought to be, is only an old man, holding the trolley pole upright in one hand and tapping along the path with a cane in the other. And the trackless system, instead of following a thoroughfare, winds about a parklike inclosure with frequent stations marked by comfortable rustic seats. The old men are blind. The trolley is the guide that leads them safely about the grounds of a home for Confederate soldiers in Texas. Between 20 and 30 of the old fighters have wholly lost their sight; but with their daily trolley trips and the long exchanges of reminiscences at the stop-over points, they are quite happy. The overhead trolley permits of more extended travel than the one used by an armless blind man at a railroad-men's home in Illinois, which was described in Popular Mechanics for January, 1916.

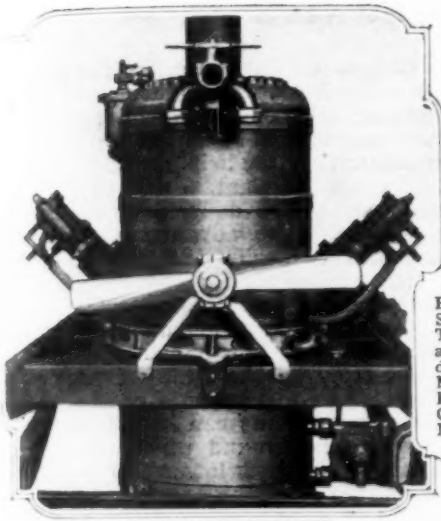
CUSTOMS OFFICERS ON WATCH FOR AIRPLANES

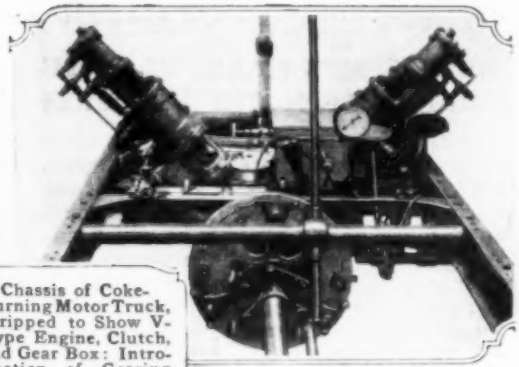
Airplane revenue cutters are foreshadowed by a decision of the customs officials to tax airplanes bought in Canada and flown into the United States. When a plane was recently imported in this way, under its own motive power, the question of duties arose, and it was discovered that airplanes are not mentioned in tariff acts. The above ruling was made, nevertheless, with the provision that the plane will not be taxed if it flies back again within six months, thus proving it was simply on tour.

¶All persons in French war service are guaranteed the return of their old jobs, at a fair rate of pay, unless physically disqualified.

BRITISH TRUCK BURNS CHEAP FUEL

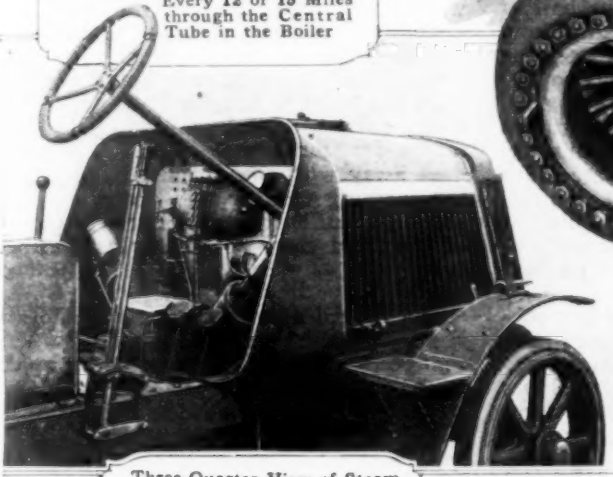
Coke is the fuel used in a new British steam-driven truck, reported to operate at a cost of about one-fourth that of a gasoline-driven vehicle of similar capacity. The coke is introduced, through the top of the hood, into a central tube which is surrounded by the boiler. This boiler is of simple design, consisting of two cylindrical steel shells flanged and bolted at each end. Withdrawing these bolts, the outer shell is easily removed, exposing the inner, which is drilled to receive 4-in. water tubes of the "thimble" variety. The engine itself is a V-type tandem compound. Two pairs of high and low-pressure cylinders operate the same crank at an angle of 90°, giving, it is claimed, freedom from vibration at speeds up to 1,500 r.p.m. The stroke is 3 in.; the high-pressure cylinders are 3 in. in diameter; the low-pressure 5 in. Oiling is handled by a dual system, a geared pump supplying general lubrication, while a drop of oil, injected into the steam pipe every 100 revolutions, maintains a film of lubrication on all inner surfaces. Another unusual feature for a steam car is the gear box, which is introduced to lessen the size of the engine, eliminate the old steam reverse gear, and make it possible to run the engine "free." Under test the engine has proved remarkably self-regulating. It ran quietly all night, adjusting water feed, lubrication, and steam pressure entirely unattended. The manual and pedal controls are similar to those of gas-driven machines, enabling comparatively unskilled drivers to run the car.

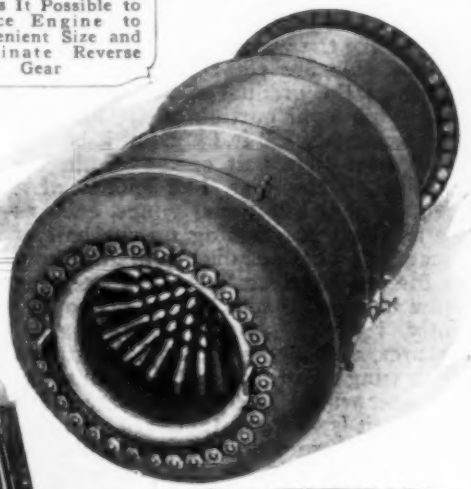




Chassis of Coke-Burning Motor Truck, Stripped to Show V-Type Engine, Clutch, and Gear Box: Introduction of Gearing Makes It Possible to Reduce Engine to Convenient Size and Eliminate Reverse Gear

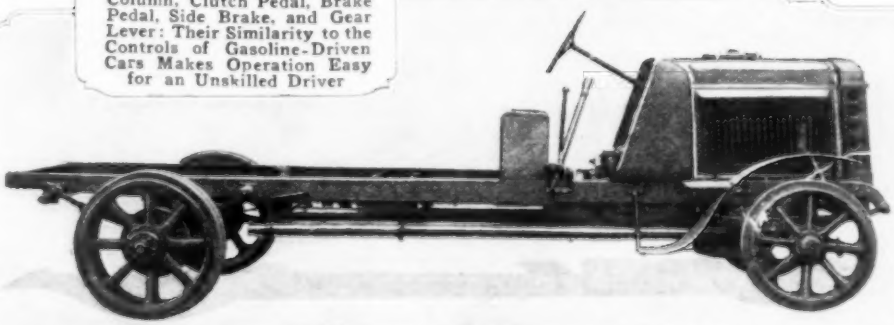
Front View of Stripped Chassis Showing Ventilating Fan and Coke-Burning Boiler: On a Three-Ton Truck the Fire is Replenished Every 12 or 15 Miles through the Central Tube in the Boiler





End View of the Coke-Burning Boiler: Made of Two Steel Shells, Flanged and Bolted Together at Each End, the Boiler may be Readily Disassembled for Inspection and Repair. Projections from Inner Surface Are "Thimble"-Type Water Tubes

Three-Quarter View of Steam Truck, Showing Steering Column, Clutch Pedal, Brake Pedal, Side Brake, and Gear Lever: Their Similarity to the Controls of Gasoline-Driven Cars Makes Operation Easy for an Unskilled Driver



Coke-Burning, Steam-Driven Truck Seen from Side: Figured on Basis of Fuel Consumption, It is Claimed That This Three-Ton Truck can Operate at One-Fourth the Cost of a Similar Gasoline Machine

UNUSUAL SITE MAKES POSSIBLE REMARKABLE HOTEL FEATURES

Contractors are now hurrying to completion a $5,000,000 hotel in Washington, D. C., which is remarkable because of the unusual arrangement of its 1,400 rooms, and because of the manner in which advantage has been taken of the steep slopes forming part of the site, particularly at the rear. Viewed from the front the immense structure forms five sides, or one-half, of a decagon. The central portion, or three units, of the building rests on the crest of a ridge and is seven stories in height, while the wings extending forward at either side are eight stories high, on account of the gradual slope toward the front. This front portion of the building is approximately 750 ft. long, but it is only a little more than half of the whole, for extending to the rear, like spokes of a wheel, are four additional wings, each as large as the units making up the half of a decagon. This peculiar fanlike ground plan for the hotel entirely eliminates the narrow courtyards and light wells so frequently resorted to in building such structures, and places most of the rooms in each wing more than 150 ft. from those in the next wing. The approximate width of each unit is 45 ft., so there are no inside rooms, and all rooms are as near on a par for location as it is physically possible to make them, each getting the same amount of air and exposure.

Toward the rear the ground slopes precipitously, so that two of the wings have four floors below the main floor which are above ground, and one of them five floors above ground but below the main floor. Only an architect who has tried to provide adequate accommodations for help, machinery, laundry, etc., in the average hotel building, can fully appreciate the advantage of such an arrangement. In these basement and sub-basement floors, all abundantly lighted by daylight, are the living quarters for the help, the kitchens, the laundry, the ice plant, with a capacity of three tons of ice daily, immense storerooms, etc. The advantages from the standpoint of health and sanitation are obvious.

But there is one other remarkable feature about this hotel and its unusual site. Just at the rear of the immense building is a three-story garage with a capacity for 300 cars, where occupants of the housekeeping apartments can keep their automobiles. The ground which the garage occupies is so much lower than the hotel that its roof comes up only to a level with the lowest basement, and its approach along a hillside is so laid out that a portion of it enters the third-story doorway, another portion the second-story doorway, and a third portion the first-story doorway. Suitable retaining walls separate the various levels of this divided roadway. While the garage is but a few feet from the hotel, it in no way obstructs the view of the beautiful wooded hills to the rear. Its three-level entrance entirely does away with the expense of elevators for carrying cars up and down, and enables a chauffeur to get a car into or out of the third story as quickly as the first story.

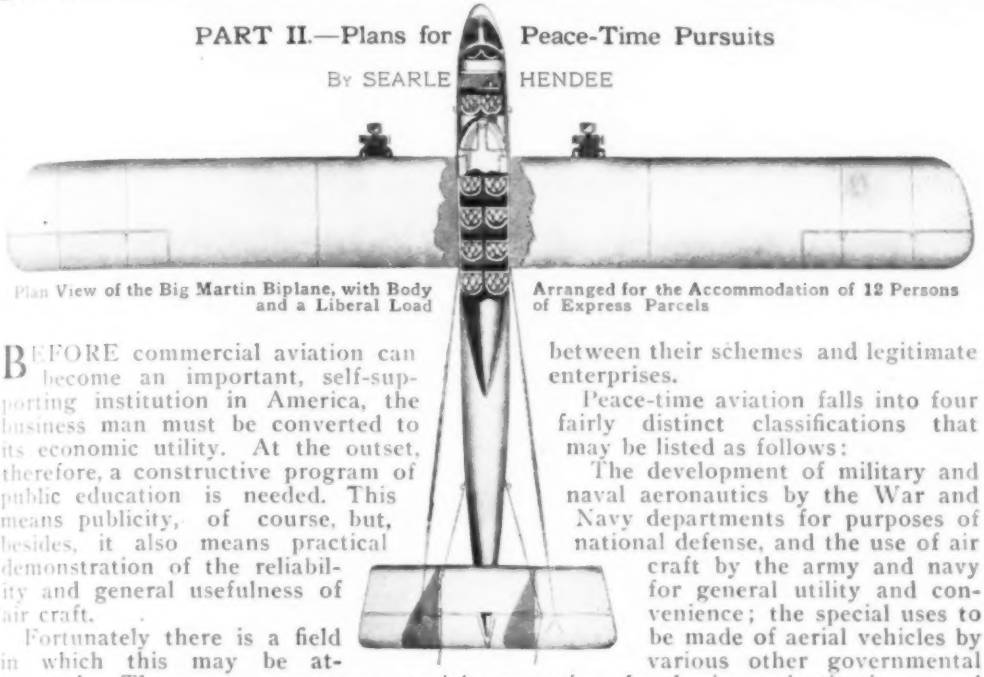
¶ The official abbreviation for California is now "Calif." instead of "Cal." The change was made by the Geographic Board at the request of the Post Office Department to avoid confusion with "Col." for Colorado. The form "Calif." has long been used as a standard by Popular Mechanics Magazine.

The Peculiar Fanlike Ground Plan of the 1,400-Room Hotel Entirely Eliminates Objectionable Courts and Light Wells, and Makes Every Room Literally an Outside One. The Garage, Indicated at the Right, is Situated at a Lower Level and does Not Obstruct the View from the Hotel Windows

AMERICA'S FUTURE IN THE AIR

PART II.—Plans for Peace-Time Pursuits

By SEARLE HENDEE



Plan View of the Big Martin Biplane, with Body Arranged for the Accommodation of 12 Persons and a Liberal Load of Express Parcels

BEFORE commercial aviation can become an important, self-supporting institution in America, the business man must be converted to its economic utility. At the outset, therefore, a constructive program of public education is needed. This means publicity, of course, but, besides, it also means practical demonstration of the reliability and general usefulness of air craft.

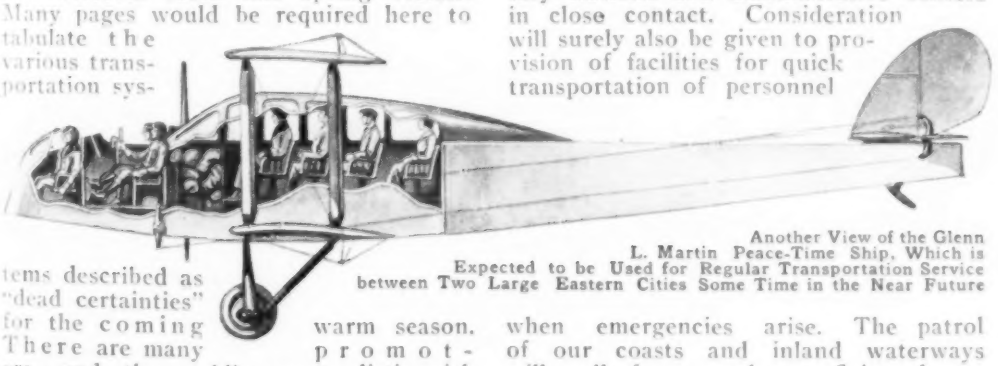
Fortunately there is a field in which this may be attempted. There are numerous special uses for which the aeroplane is ideally adapted. They offer a nucleus around which to develop commercial flying. As the air craft makes good in these special capacities, a wider appreciation of its possibilities will be grasped by the laity. Gradually a general demand no doubt will be created for the particular kind of service it can supply. As this grows, civil aerial transport in the broad sense of the term may be expected to become a substantial reality.

If one is willing to accept without analysis the assurances freely given at every hand, he can satisfy himself in a few minutes that, with the arrival of summer, aerial passenger and freight lines will blossom forth like spring violets. Many pages would be required here to tabulate the various transportation systems described as "dead certainties" for the coming warm season. There are many promoters, and the public must distinguish between their schemes and legitimate enterprises.

Peace-time aviation falls into four fairly distinct classifications that may be listed as follows:

The development of military and naval aeronautics by the War and Navy departments for purposes of national defense, and the use of air craft by the army and navy for general utility and convenience; the special uses to be made of aerial vehicles by various other governmental agencies, by business institutions, and private individuals owning and operating their own machines; maintenance of general passenger and express service over mapped routes between definite terminals on established time schedules, and taxi service between large centers and surrounding points; civilian flying for pleasure and sport.

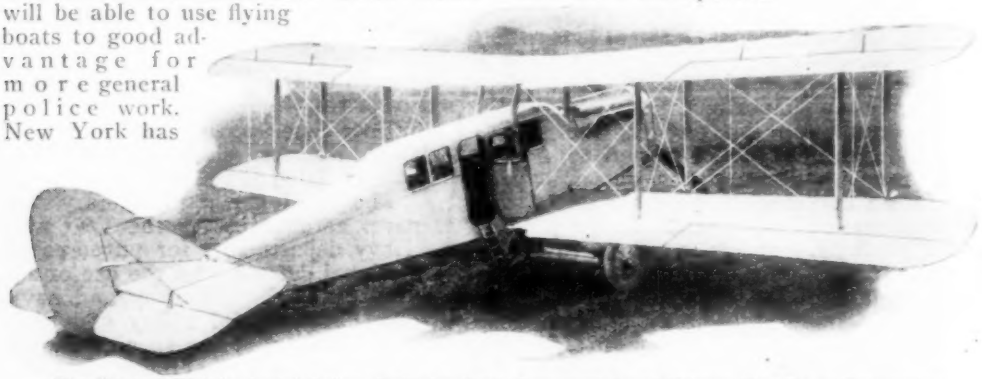
In general respects no further explanation is needed of the army and navy phases of the subject. Obviously the War and Navy departments are expected to execute programs commensurate with the country's need for defense. On the other hand, in maintaining the military establishment, aeroplanes will no doubt be used for keeping the various military districts and administrative centers in close contact. Consideration will surely also be given to provision of facilities for quick transportation of personnel when emergencies arise. The patrol of our coasts and inland waterways will call for aeroplanes, flying boats,



Another View of the Glenn L. Martin Peace-Time Ship, Which is Expected to be Used for Regular Transportation Service between Two Large Eastern Cities Some Time in the Near Future

and dirigibles. In line with this will be the probable development of machines suited for the use of internal-revenue officers detailed for river and harbor work.

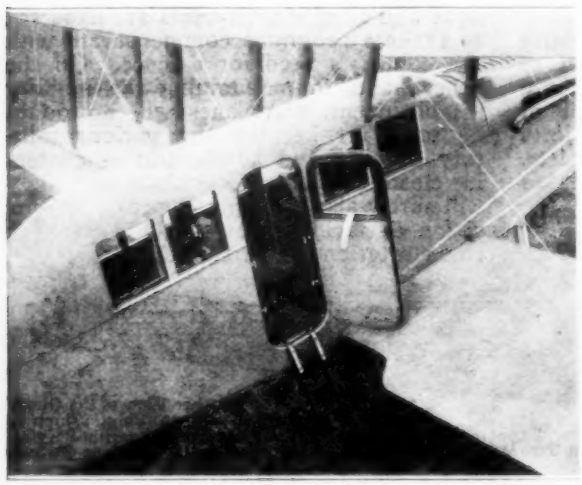
The necessity of policing the air will come as a natural consequence of civil flying. Sturdy planes of high speed and low landing speed will be needed for traffic regulation along air lanes. Ports and other cities that have water fronts will be able to use flying boats to good advantage for more general police work. New York has made a step in this direction, and a California city has lately added a "flying fire boat" to its equipment for fire detection and prevention.



The Dayton-Wright Aerial Sedan, Built for Both Commercial and Private Use, Is an Interesting New Biplane That has Appeared Since the Conclusion of Hostilities, and Which Promises to Fill a Place in Peace-Time Air Navigation

The aerial mail, already instituted by the Post Office Department, will call for many planes as the service is extended. As more routes are established and the public becomes accustomed to the air post, reasonable support is to be expected. It is true that during the few months post-office planes have been in operation, the volume of business has been light. For instance, during October last, only 939¾ lb. of "aeroplane mail" were carried. The total amount of business for the month, therefore, was not in excess of one normal full load. To make up the deficiency, 15,848½ lb. of ordinary mail were transported.

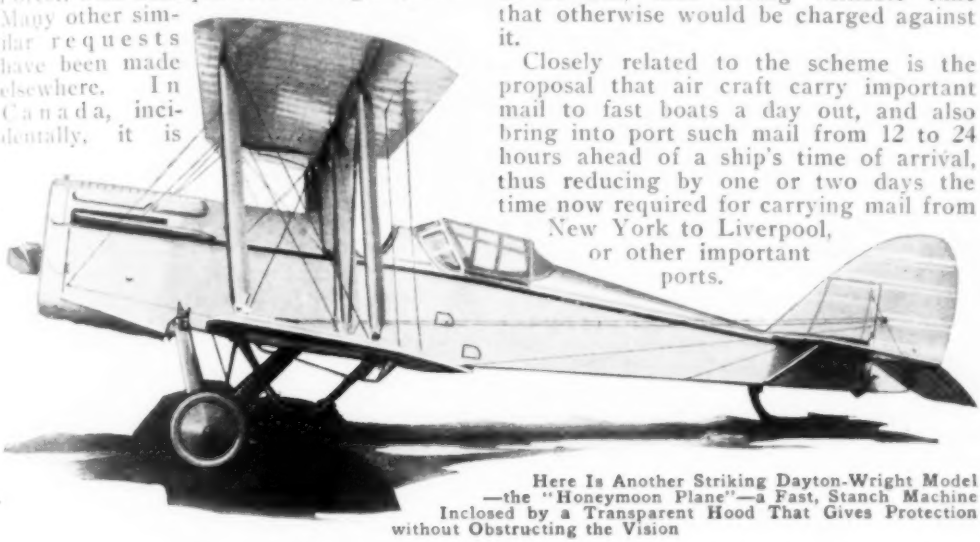
Clearly, however, it is not vital that the cost of aerial post be borne solely by the service itself, so long as there are well-founded national reasons that make highly advisable all possible development and use of aeroplanes. It is not the purpose here to make predictions, yet it may be said with reasonable safety that the time is now rapidly approaching when every city of importance, and towns now out of the direct line of communication with large industrial centers, will undoubtedly have regular and dependable aerial mail service. There are grounds also for the assumption that remote districts, and those temporarily made remote by floods and snow blockades, will be served before long.



This Gives a Close-Up Glimpse of the Body Arrangement of the Flying Sedan. The Cabin is Pleasingly Appointed and Affords Complete Protection from the Elements

Aerial photography opens an important field of value alike to government agencies and private interests. The Geographic Survey will be able to make good use of it, while its aid in engineering projects, mapping, and topographical work in general will be of great advantage. It is likewise conceivable that the Geodetic Survey will have uses for aircraft in furthering some of its work.

The Forest Service contemplates employing aeroplanes in different capacities, but especially for mapping and fire-detection and fighting purposes. The utility of the air craft for such functions is too obvious to require elaboration. A requisition for 10 planes for patrol service in the Northwest was recently made by the supervisor of the Cascade National Forest, with headquarters at Eugene, Ore. Many other similar requests have been made elsewhere. In Canada, incidentally, it is expected that the Northwest Mounted Police will use air craft quite generally in their manifold activities.



Here Is Another Striking Dayton-Wright Model —the "Honeymoon Plane"—a Fast, Stanch Machine Inclosed by a Transparent Hood That Gives Protection without Obstructing the Vision

Much has been said of late regarding the employment of air craft for life-saving and exploration. Both offer interesting, although perhaps limited, fields for experimentation. Already plans are under way for an arctic expedition which may or may not be carried out in the near future.

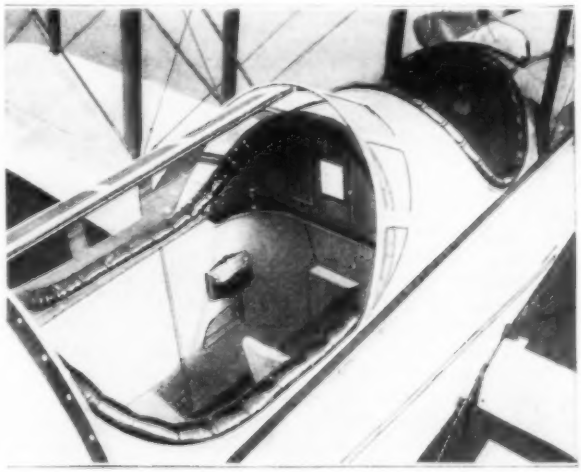
The Weather Bureau has indicated that aeroplanes may play an important part in the study and mapping of air currents, and in general meteorological work.

At least one steamship company is preparing to use fast air craft to transmit clearance papers and other documents for the handling and discharge of cargo at ports of destination, to its vessels at sea. The advantage of this is a timesaving of from 36 to 48 hours in the dispatch of freighters.

Here, the fact that, under existing conditions, a ship cannot depart without clearance papers, bills of lading, agent's instructions, and other documents, often makes it necessary to hold a steamer at its pier, or at anchor, until such papers can be prepared and placed aboard. With aeroplanes in use it will be possible for a ship to put to sea as soon as its cargo is loaded, and receive the papers when a day or so out, thus saving valuable time that otherwise would be charged against it.

Closely related to the scheme is the proposal that air craft carry important mail to fast boats a day out, and also bring into port such mail from 12 to 24 hours ahead of a ship's time of arrival, thus reducing by one or two days the time now required for carrying mail from New York to Liverpool, or other important ports.

Several manufacturers of air craft assert that mining concerns are considering the experimental use of air craft in connection with the development of prop-



Discreetly Enough, the Pilot's Position in the "Honeymoon Plane" is Placed Well Forward, and Entirely Separated from Cabin, Which is Fully Covered. The Picture Also Shows the Seating Scheme and the Appointments in the Passenger Compartment

erties that, with ordinary means of communication, are inaccessible. Harry Bowers Mingle, president of the Standard Aircraft Corporation, says that Alaska, because of its great mining wealth that lies untapped on account of the lack of transportation facilities, offers a particularly good field for commercial aviation.

Some oil companies are contemplating the substitution of aeroplanes for motor cars as means of quick transportation between various properties. In oil fields, particularly when development work goes on, speed such as the air craft affords is advantageous, not only for enabling officials and those in charge of important operations to visit different points without loss of valuable time, but also for the conveyance of needed parts of machinery when emergencies arise. With the facilities at hand, money for meeting weekly payrolls could also be transported with less difficulty and hazard than is at present the case in some localities.

Large firms, having general offices at one point and factories and branch houses at other places not far distant, in certain cases may find the aeroplane useful for intercommunication eventually, but at the present time there seems to be much more likelihood of the rancher doing so. Several stockmen are already reported to have placed orders for planes.

These represent only a few of a long list of potential business uses of the aeroplane and flying boat upon which the air-craft manufacturers are counting for support. The more important of them are related to aerial transport of a general nature.

There are many transportation lines under contemplation for the near future. To state definitely that any one of them will be established and in operation June 1, or July 1, as promised by those backing them, is more than a conservative reporter is called upon to do. Manufacturers and operating syndicates face at this time many uncertain conditions, and while some of them confidently expect to execute definite programs in the coming few months, it remains to be seen just what will really be accomplished.

One transportation line that has excellent chance of being opened soon, however, is the New York-Atlantic City flying-boat system that the Curtiss company has scheduled for this summer. It is planned to use "HS-2" and "H-16" type craft and extend the service, once it is in operation, to Miami, Fla., and perhaps Cuba. Passenger rates will amount to about 50 cents a mile. The same company in addition intends to inaugurate a "land livery service" some time this spring. The routes to be flown have as yet not been made public.

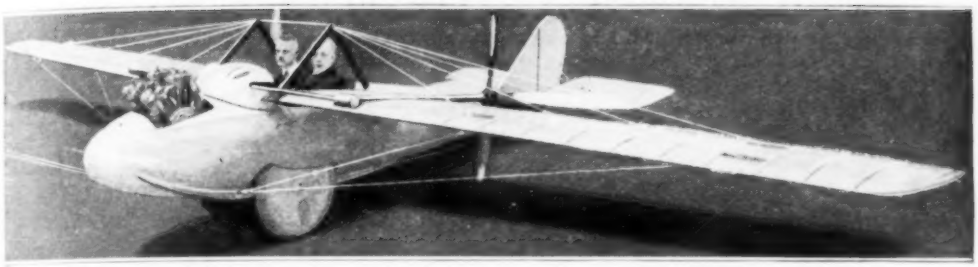
The Curtiss company is also authority for the statement that an independent operating concern is making preparations for the institution of passenger and express service between various ports on the Great Lakes, including such cities as Buffalo, Erie, Cleveland, Toledo, Detroit, Port Huron, and Chicago. Curtiss flying boats will be used on these routes when they are opened.

The United Aircraft and Engineering Corporation, with headquarters at New York, is thoroughly convinced that there is a real future in store for commercial aviation. It has under way the establishment of a trial route, of approximately 50 miles, from Toronto to Hamilton, Canada. Assurance is given that the line is to be put in operation within a few weeks.

It is this corporation that recently bought outright from the British government aeroplanes, motors, and spare parts in Canada, originally valued at $10,000,000. Most of the equipment is to be retailed and special machines of three types will be developed for the transportation service. In addition, the concern, believing a demand exists among landscape architects, map makers, engineers, and others, for aerial photographs, is organizing a commercial aerial photographic service. Planes, cameras, and accessories have already been provided for this work, which will be executed by contract.

The purpose of the Toronto-Hamilton trial route is to ascertain exact operating costs and problems. The information will be used as a basis for arranging schedules and fixing rates. As rapidly as is consistent with good business, it is planned to extend the system to other parts of the Dominion.

The famous Martin bombing plane, which travels 118 miles an hour and carries a useful load of two tons, is coming forth as an aerial passenger and freight-carrying craft. The body is being redesigned for these purposes, but the machine otherwise will remain unchanged. An operating company is to use the new craft for scheduled service between two large eastern cities, about 100 miles apart. In connection with the Martin company, it has made a comprehensive survey of the problem before it, and has worked out



The "Chummy Flyabout," a Distinctive, New Two-Passenger Monoplane Introduced during the Past Few Weeks: It is Intended as a Medium-Priced Craft for General Sporting and Pleasure Uses by Aerial Devotees

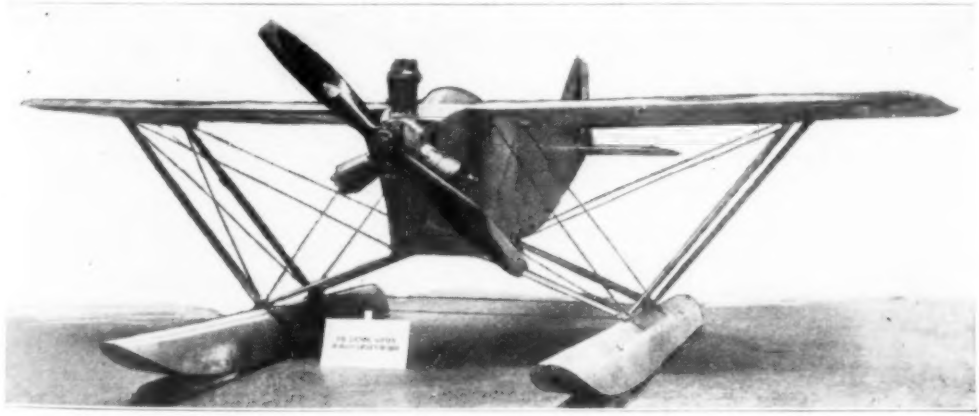
very interesting data. Although I am not permitted to give details divulging operating expenses for labor and material, or overhead distributions, it may be announced that the project involves a capital investment of $650,000. Assuming that the ships average 75 per cent of maximum load, they will do a gross yearly passenger business of $1,700,000. And if each plane carries an average of 100 lb. of mail each trip, this part of the business will amount to $368,640. These two items give an estimated net yearly profit of $600,000.

The company plans to operate six machines, each capable of carrying 12 passengers and several hundred pounds of express matter. Flight will ordinarily be made at a reduced speed of 102 miles an hour and at an elevation of 6,000 ft. The time schedules are based on a head wind of 20 miles an hour and a speed of 82 miles. When a 30-mile head wind is encountered, the motors will be operated at full throttle, while head winds greater than 30 miles will cause the schedules to fall.

The life of each plane is placed at 1,200 flying hours. Although at the end of the period the majority of the parts will still be serviceable, the plane will be written off in the cost estimates as a complete loss in order to compensate for whatever spare parts have been substituted during the life period.

The total number of trips made during the life of a machine will be 960. To maintain a craft in the air 1,200 hours, 60 working days will be required for repairs. In six months six planes will use 24 motors, which will need new parts to the extent of 10 per cent of their value each time they are overhauled.

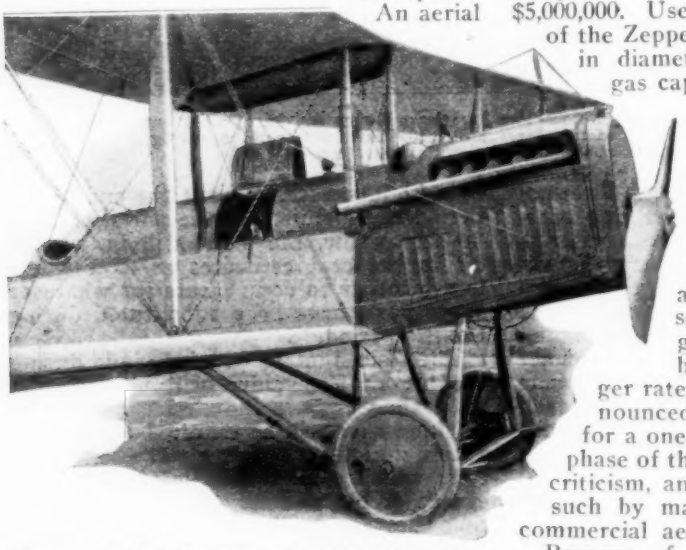
The schedule on which the calculations have been based provides a plane a "breathing spell" of 45 minutes between trips at each terminal, and since it is 15 minutes slower than the actual average running time, a full hour, as a rule, will be available for discharging and taking on passengers and express, filling the fuel tanks, and making minor adjustments. Ample time thus is given for getting a reserve plane from the other end of the line, if necessary, for replacement in case



Reputed to Be the Smallest Practical Seaplane in Existence, This Tiny Loening Craft is Well Designed and Stanchly Built. It was Exhibited in New York Recently and Attracted Much Attention Both from Aeronautical Engineers and the Public Generally

of injury in landing. Furthermore, since the next ship on the schedule would actually be due at the "damaged ship's" time of departure, it could be used for replacement and its own return trip made by the other machine after the completion of repairs.

An aerial passenger and freight system requires a much larger personnel than one would think. The particular system in question plans to have a force proportioned as follows:



Showing the Mail Compartment of One of the New Curtiss Postal Planes Developed for the Use of the Post Office Department: Rapid Extension of the Aerial Mail Service is Expected in Aeronautic Circles

Executive personnel: general manager, treasurer and accountant; passenger agent and publicity manager; assistant general manager; chief engineer; four inspectors, and eight stenographers. Operating personnel: a chief pilot and operating manager; 14 pilots; 10 flying mechanics; four ticket agents; four starters; 40 field mechanics; four bus drivers, and four wireless operators. Maintenance personnel: two shop superintendents; one purchasing agent; one assistant purchasing agent; six shop foremen; 60 shop mechanics; four draftsmen; two shop maintenance men; four watchmen, and four stenographers.

Passenger and freight rates have not been definitely announced, but it is understood that passengers will be carried for about 20 cents a mile.

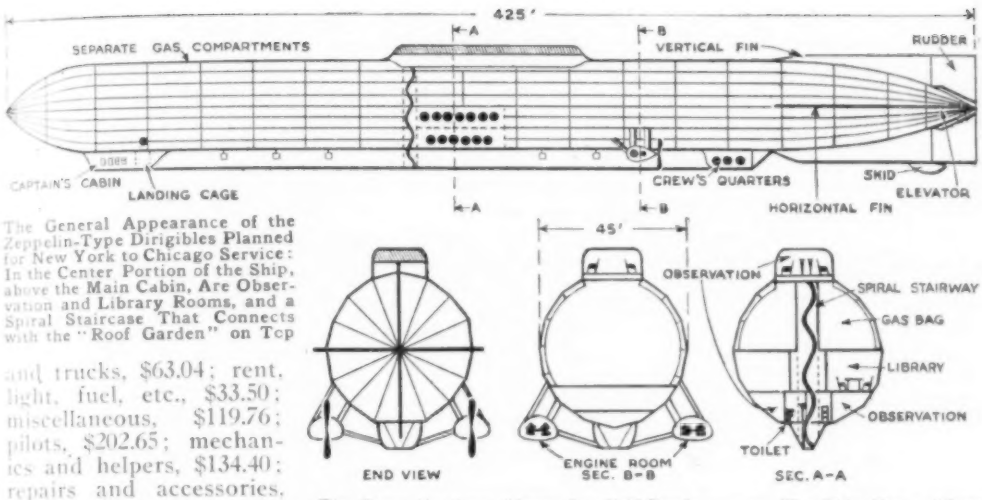
Turning attention for a moment to the dirigible, which for long-distance and heavy-load operation has certain points of advantage now that helium gas is taking the place of hydrogen, plans are under way for the inauguration of 12-hour airship service between New York and Chicago. The enterprise is fathered by interests identified with the Sturtevant Aeroplane Company of Boston, and contemplates a capital investment of $5,000,000. Use is to be made of dirigibles of the Zeppelin type, 425 ft. long, 45 ft. in diameter, and of 650,000-cu.-ft. gas capacity. According to some reports the ships are now under construction. At least, however, they have been designed. Equipped with motors aggregating 1,200 hp., they will easily carry useful loads of 10 tons and maintain 70-mile-an-hour schedules, it is asserted. Twenty-five passengers and a crew of 10 will be accommodated. Passenger rates have been tentatively announced as 65 cents a mile, or $52.00 for a one-way trip. Admittedly this phase of the project is open to serious criticism, and has been the subject of such by many of those interested in commercial aeronautics.

Because of the long flying radius of dirigibles, and the fact that motor trouble does not affect them so vitally as it does aeroplanes, their potential value for commercial use is considered great. One company is now being formed, ostensibly for the purpose of inaugurating dirigible passenger and freight service between New York and South American ports. The use of Italian-built ships has been decided upon, and a passenger rate of approximately 10 cents a mile proposed.

It will be observed, from the foregoing, that the question of rates and costs is one about which there is great variance of opinion. Charges of from 20 to 50 cents a mile are planned by aeroplane companies, and from 10 to 65 cents by airship companies. Obviously there is a good deal to be learned about the commercial operation of air craft.

The whole future of the enterprise is bound up in the problem of costs. The December report of the Post Office Department, covering the cost of operating and maintaining postal planes, throws interesting light on the subject. The record of two of the planes, showing the distribution of overhead as well as other items, follows:

Gasoline, $129.98; grease and oil, $22.24; office force, $40.21; motorcycle



The General Appearance of the Zeppelin-Type Dirigibles Planned for New York to Chicago Service: In the Center Portion of the Ship, above the Main Cabin, Are Observation and Library Rooms, and a Spiral Staircase That Connects with the "Roof Garden" on Top

The Cross Sections Above Are Self-Explanatory. The Ship Has a "Roof Garden" and is Designed to Carry 25 Passengers and a Crew of Ten

and trucks, $63.04; rent, light, fuel, etc., $33.50; miscellaneous, $119.76; pilots, $202.65; mechanics and helpers, $134.40; repairs and accessories, $249.76; interest on investment, $70.11; departmental overhead charge, $85.31; total, $1,150.96; total time run, 23 hours and 38 minutes; total miles run, 1,706; miles run per gallon of gasoline, 4.13; cost per hour, $48.69; cost per mile, $.6746.

On the other hand, averaging the expense of operating 16 postal planes throughout the month, a cost of $95.05 an hour, or $1.3551 per mile, is shown for each machine.

Where is the high-price business for such high-priced service to come from? If there is anyone who absolutely knows, he is keeping the information to himself. The whole project is a speculative one. It remains to be proved that commercial aviation can be supported profitably. Here, however, are some of the possible sources of business upon which prospective operating companies are pinning faith:

Passenger traffic in general divides itself into two classes, namely, that which is for business, and that which is for pleasure. Speed is of vital importance to many business men. Some, for instance, have necessary trips to make at times they can ill afford to be absent from their offices. To make such trips and accomplish their work in a day or two, instead of spending a week at it, often would be worth thousands of dollars. It is conceivable, too, that the high-salaried representative traveling to South America, China, or some other distant locality, might well afford to proceed by air craft, considering that salary, expenses, and loss of time would be more expensive than fast travel at high cost per mile. In every large city there are men of wealth who, on occasions, would spend almost any reasonable amount of money to reach some other city in a few hours. Likewise when life is involved, and an eminent surgeon or physician needed; when industry is threatened by an impending strike, or at a standstill for lack of technical assistance, time is more valuable than money. As for

"The Messenger," a Side View of Which is Presented Here, Is an Attractively Designed Little Biplane That is Coming Forth as a Dayton-Wright Sporting and General-Utility Craft for Civilian Use

the other half of our travelers, those who are pleasure-bound, it is conceivable that many, for the sake of novelty or variety, would make use of air routes.

Transportation by aeroplane in regions now made remote by lack of railway facilities or because of poor steamship service, offers real advantages. In South America, in northern Canada, in Alaska, and other places on the continent, an aeroplane can travel between points in a few hours that by other mediums of transportation are days and even weeks apart.

Many of these same general conditions have a bearing on the aerial express business. Perishable products in some instances might be handled advantageously by air craft. Under this classification would come rare and costly fruits and flowers, and products of quite different character with value that depends on quick distribution. Of the latter group, newspapers and news films are cited as examples. Moving pictures of great news interest, for instance, filmed in New York in the afternoon and exhibited in Boston, Philadelphia, and Washington theaters in the evening, would have much greater value than if shown the following day. The same is true of newspaper photographs. If Chicago newspapers, for instance, received pictures the same day they were taken in New York, St. Louis, or Kansas City, their value would be several times greater than it now is.

Not long ago progressive assemblage in a large Detroit motor-car plant was interrupted because of delay in arrival of a shipment of valves manufactured in Cleveland. Aeroplane delivery would have saved a loss of several thousand dollars in time. Similarly it often occurs that a large plant is brought to a standstill by disablement of some vital machine. In the oil fields and the mining regions a breakdown of the power equipment may cause serious difficulties. For lack of a single spare part great financial loss may be incurred. Here again aeroplane delivery comes to the fore.

Aerial post enables a business firm to forward a 5,000-word letter for no greater cost than a 50-word night message by telegraph, and obtain, within a radius of about 800 miles, equally fast service. It also permits the quick delivery of important papers, thus allowing contracts to be signed and other transactions completed, between firms and individuals in different cities, at a great saving of time.

Very few of the most optimistic backers of civil aerial transport expect a sufficient volume of business at the outset to support the enterprise. They see a long, hard pioneering task ahead. But be this as it may, they are confident that in the long run the idea will pay out.

Grover Cleveland Loening thinks that taxi service will pay long before regular scheduled service can be made profitable. He assumes that in New York, or Chicago, for instance, enough emergency business arises daily to support an aerial transportation company that would have a centrally located aerodrome with machines ready for fast flights at a moment's notice to any point of the compass.

Glenn L. Martin, admitting that commercial aviation will have a hard fight for business in the near future, contends that railway-operating ideas must be adopted. "Commercial lines over long routes," he says, "as between New York and Chicago, must have division points where passengers and express may be transferred to 'fresh' machines. An 800-mile line, or an 8,000-mile one, is absolutely feasible from an operating standpoint if it is made in relatively small jumps."

One of the most interesting of the recent developments to give material aid to civil aerial transport is the wireless compass. This is rapidly nearing a state of completion, and is an instrument that will reduce hazards to the minimum. As

THE QUEST OF THE CLOUDLAND FLEECE

By SOPHIE E. REDFORD

Like gray moths waiting to spread their wings
Unfinished air craft stand.
Mute prophecies they, of wondrous things
By bold adventure planned.
Across their bodies the workmen creep,
Tuning their shafts aright,
For a birdman's ready his tryst to keep
With a record-breaking flight.
Oh, which shall be first 'mongst these to rise,
From its chrysalis state set free,
To win for man his coveted prize
In the race to span the sea?
Oh, craftsmen, temper the brace of steel,
Oh, cable the aileron true;
The hand that will pilot the sky-boat wheel
Is trusting his nerve, and—you!
Oh, bolts and sockets and cotter pins,
Propellers and struts and stays,
Whatever the name of the man who wins,
With you he must share the praise.
When out of the factory, mine, and mill,
The forest and field and stream,
The man and the man-made bird fulfill
The "Transatlantic Dream"!

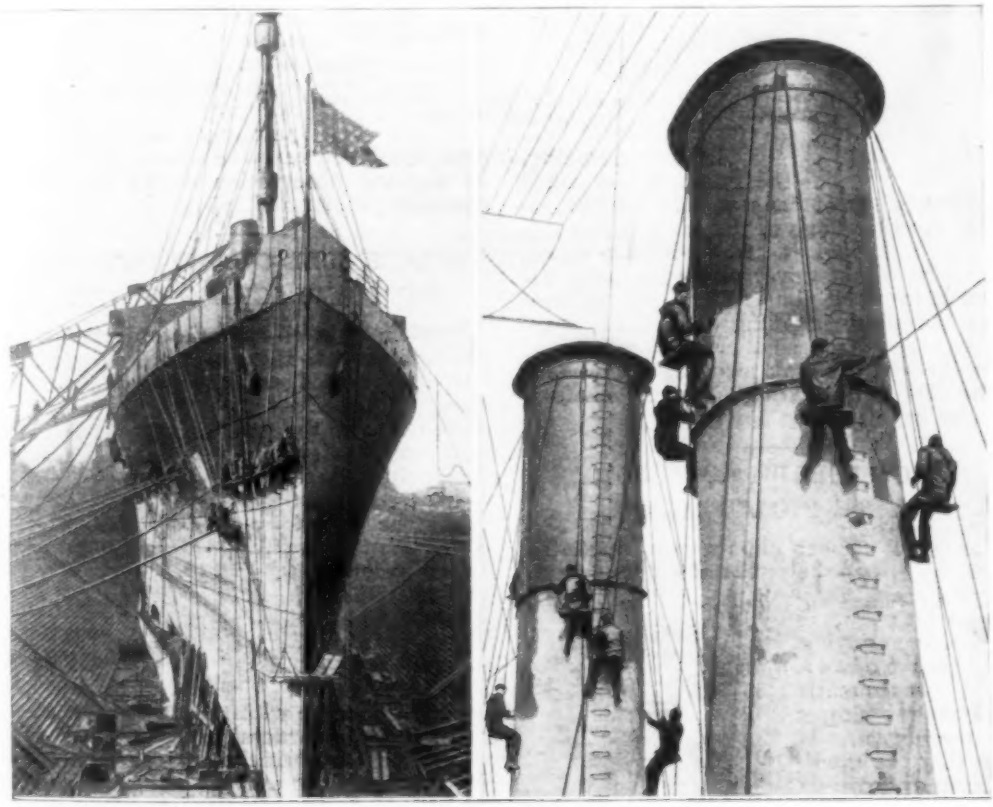
previously mentioned, fog and darkness, but especially fog, often make landing extremely dangerous. The wireless compass is designed to indicate the position of an aerodrome and enable a pilot to "feel" his way down until the field becomes visible and a safe landing can be negotiated. The instrument has been perfected to within 3° of accuracy. Further refinement is expected to overcome all error. When this is accomplished, and radio-equipped fields are established at frequent intervals, a fog-bound ship, even facing the necessity of a forced landing, will be able to reach the ground in safety.

To many, the sporting phases of aviation hold chief interest. Since flying became a mechanical possibility, thousands of persons have visualized the time when aeroplanes would be as common as family vehicles.

What can be said, then, of this side of the subject?

Cost is the answer. At present the aeroplane is in the private-yacht class. There are thousands of persons financially able to own and operate planes. There are scores who will do so. But widespread flying—that is, flying on a scale such as motoring enjoys today—remains for the years to come.

Good machines are available at prices ranging from $5,000 or a little more, to $45,000 and as much more as one is willing to pay. After this comes the upkeep, which, unfortunately, is expensive. Efforts, however, are being made to develop small, safe, moderate-priced planes that will be in the motor-car class as concerns operating costs. That success in this commendable endeavor will broaden the sporting use of aeroplanes immensely is too obvious to require comment.



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BIG TRANSPORT WHICH RAN AGROUND IS UNDERGOING REPAIRS IN DRY DOCK

WITH all the lines of its gigantic hull showing in imposing aspect, the transport "Northern Pacific" lies in dry dock. The big ship ran aground off Fire Island a short time ago, and is undergoing repairs. On account of the overhang, scaffolding for painting the sides had to be braced from the dock. Bluejackets from the navy yard hang suspended on little individual scaffolds while they paint the giant smokestacks.

MUNICIPAL AUTO TRUCK SERVES MANY PURPOSES

A new auto-mounted pumping apparatus should be a versatile and efficient addition to any municipal equipment. Used for cleaning sewers, catch basins, or gullies; for tree spraying, or general long-distance pumping, the pump is controlled by the driver at his seat, and has the advantage that none of the sediment or solids pass through it. And with the simple removal of the cover plates the body becomes available for hauling and mechanical dumping, handling coal, ashes, garbage, etc. Used as a sprayer, again, the contents of the tank may be kept in solution by an agitating feature which is easily regulated by a valve.

This Truck will Clean City Sewers, Spray Trees, Carry Building Material, or Haul and Dump Garbage

PHONOGRAPH ACCESSORY LIKE VIOLIN MUTE

A small rubber clip is now marketed that fastens to the stylus of a phonograph reproducer, eliminating, it is claimed, annoying, scratchy noises, and consequently insuring clearer reproduction. By moving the modifier up or down on the stylus, added control of sound volume is secured. A slight pressure on the bottom opens the rubber jaws of the attachment.

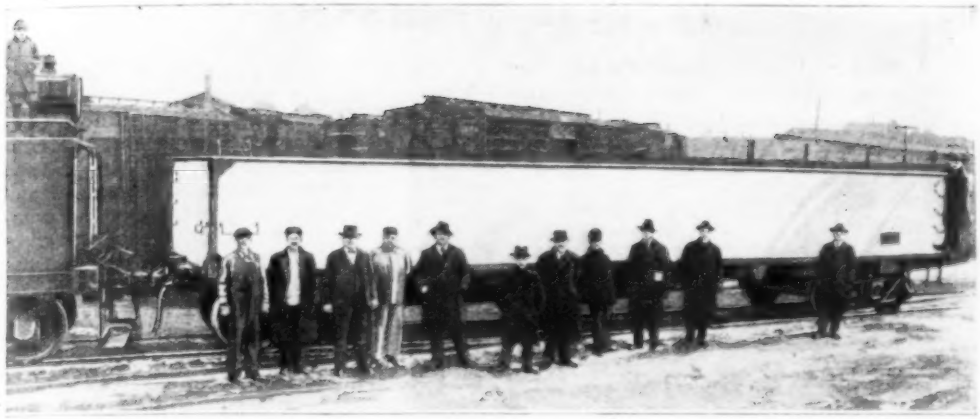
AERIAL RADIOPHONE A MARVEL FOR ARTILLERY ADJUSTMENT

A flier who knew nothing about artillery adjustment until just before his flight gave successful gunfire commands through the aero radiotelephone in a recent test at a western field. After his first lesson in adjusting fire he took full control of the battery from the air. In his first problem he ordered 22 rounds in 19 minutes. Then, in 14 minutes, he adjusted the range, ordered 16 rounds, including six in improvement fire, and brought up another gun. The next day he corrected the fire of the whole platoon, finding no trouble in catching and rectifying errors intentionally set against him. This result is taken to demonstrate that a trained artilleryman, with the aero radiophone, can adjust fire from the air with extreme ease and accuracy. The instantaneity of telephone orders, combined with the visual supremacy of airplane observation, make the most complex problems simple.

DETACHABLE GUARD FOR SINK STOPS SPLASHING WATER

Kitchen sinks all have the objectionable characteristic of allowing water to splash over the front edge, with moist and messy consequences. Designed to stop the nuisance is a light detachable guard, which, slipped over the sink edge, stands up like a water-tight wall to hold back the misplaced spray. It is high enough for full protection, but does not interfere with the free use of the sink. Round corners and absence of seams keep the attachment sanitary. It is quite light, and may be hung up when not in use.

¶American lads are now replacing aliens almost entirely in the firerooms of American merchant ships.



Gondola Freight Car with Concrete Body: The Steel Frame at the Corners and Upper Edges Is Plainly Apparent in This View, Which Also Gives Some Idea of the Smooth, Uniform Outer Surface Obtained by the Method of Shooting the Mixture against the Forms with a Cement Gun

CONCRETE FREIGHT CAR IN SERVICE

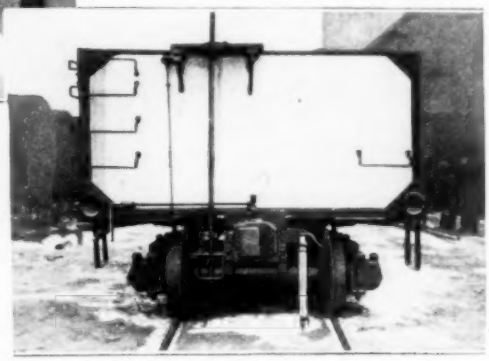
A GONDOLA freight car with a body made entirely of reinforced concrete is now in actual railway service. The finished car, first of its kind, was ceremoniously delivered by its designers to the Illinois Central Railroad, on March 17. It was immediately started on a trial trip over the lines of the system, and for 30 days will encounter all the normal uses and abuses of the hard-working gondola-type car. At the end of that period it will be turned over to the United States Railroad Administration, which will thereafter dictate its use and service. The thoroughly tested, and accepted, car represents the fruition of the plans announced in Popular Mechanics last August, and so adds one more to the list of great permanent industrial advances spurred to accomplishment by the emergencies of war.

Method of Reinforcing the Concrete Body with Steel Bars Braced Obliquely in the Frame: On the Cross Bearers in the Floor the Concrete was Molded in Forms in the Customary Manner

The concrete body of the car is framed in a steel skeleton, whose lines follow the vertical outside corners and horizontal edges. A steel underframe, of similar design, forms the foundation. Frame and underframe, as well as braces and reinforcing bars, are so connected and interlocked as to distribute drawbar and other stresses over the whole structure. Railroad Administration standards for a coal car of 100,000-lb. capacity with a 10-per-cent overload factor, were followed in the design. Taking 200,000 lb. as the drawbar pull, the unit stress in the steel figured at 16,000 lb., and in the concrete, 1,000 lb. The finished car is 41 ft. 6½ in. long, over all, and 10 ft. 2⅞ in. wide, and the sides of the body are 4 ft. 10½ in high. While the model now in service has a solid body for the sake of simplicity, the principles of the design indicate ready modification into the dump-car type for subsequent production. Box and flat cars, as well as the specialized forms peculiar to certain services, will follow without difficulty the precedent of the gondola model, selected for the test because all the hardships of the road fall to the lot of that particular type.

A special, light aggregate, developed by an engineer of Kansas City, Mo., found its first commercial application in the concrete mixture used for this car. Its normal weight of 104 lb. per cubic foot was slightly increased by the method of forming adopted. The mixture was shot against outside forms by a cement gun inside the frame. The result of this process

was a floor and walls unusually thin but very dense. The more bulky crossbeams



On the Inside of the Car, as Seen Above, the Concrete Remains Much as the Cement Gun Left It, Which Is Sufficiently Smooth for the Uses to Which a Gondola Car is Put. The Ribs along the Sides Cover the Bars Connecting the Bottom Cross Bearers with the Top Frame, as Seen in the Reinforcement Picture. At the Right Is an End View of the Car, with All the Usual Freight-Car Fixtures in Place

of the underframe were formed by pouring in the ordinary manner. The inside surfaces were left as the cement gun finished them, but the outside walls are quite smooth because of the close cohesion with the forms. Completed, the car weighed about 3,600 lb. more than was calculated; subsequent similar models, however, can readily be kept within the bounds of 46,000 to 48,000 lb., approximating the standards of steel gondolas.

The designer, a prominent Chicago engineer, had the coöperation of Railroad Administration and Illinois Central officials throughout the construction of the first car. Now a company has been organized and is developing plans for the commercial construction of concrete freight cars of all types along the lines pioneered by this model. It is interesting to note here that European engineers also are paying some attention to the possibilities of the concrete car. The first model, cast in one piece, was successful, but had a capacity of only six tons. The second trial resulted in improvement, and a plant is being erected at Doetinchem, Holland, whose manufacturing facilities will be devoted to this new industry.

MOTORCYCLIST BALANCES SELF AND CAR IN AIR

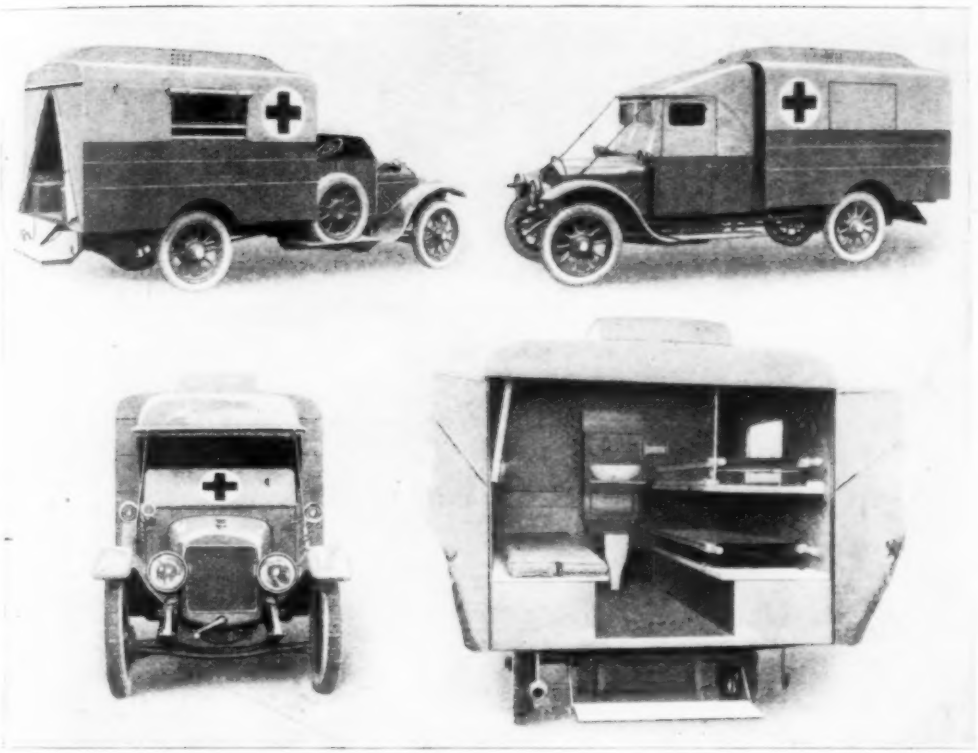
One motorcyclist goes them all one better by driving on two wheels, balancing himself and his sidecar in the air. At a speed of 25 miles per hour few will care to attempt this trick. It is nothing for this expert, however, who discovered he could ride this way while performing motorcycle and sidecar tricks for a motion-picture firm.

COPYRIGHT, JOHN EDWIN HOGG

This Motorcyclist Rides about Town in His Sidecar While Tilted Up on Two Wheels

AIR COMPRESSOR FEEDS AIRPLANE ENGINE

Slower speeds at higher altitudes has been regarded by airmen, heretofore, as one of the rules of the game. But not much longer, if a Frenchman's attachment is as successful generally as in experiment. As described, his idea is a simple one, involving only a turbine air-compressor which is driven by the engine exhaust and feeds the intake with air of normal density. With the engine thus developing full power at all altitudes, it seems that more, rather than less, speed will be possible as the plane climbs higher and encounters rapidly decreasing air resistance.



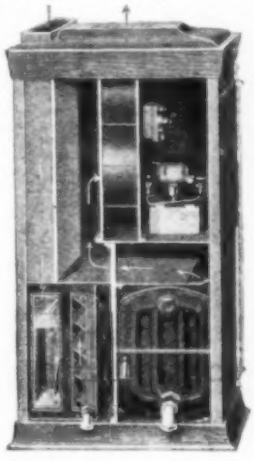
At the Top, and Below at the Left, Are Open, Closed, and Front Views of a Much Used British Type of War Ambulance. The Rear View, Lower Right, Shows Stretcher Space, Box Seats, Attendant's Seat, and Locker at Front. This Model Has Flat, Easy Springs Like a Railway Coach

AMBULANCE REFINEMENTS GIVE GREATER EASE AND COMFORT

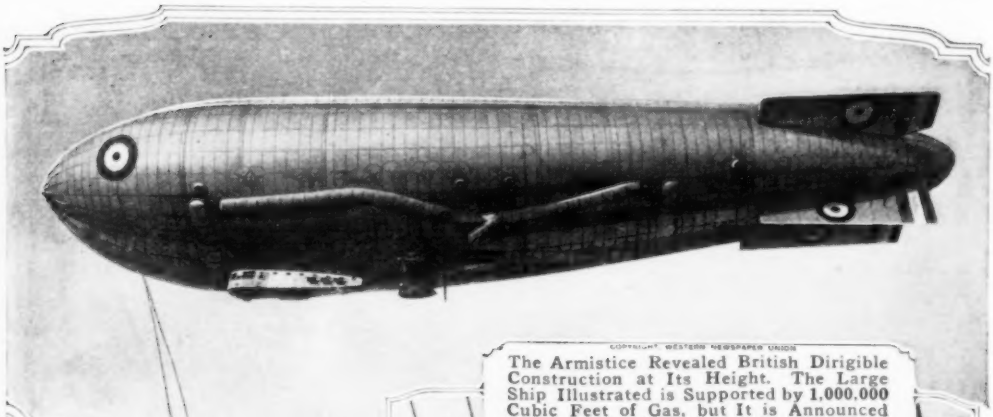
Long-distance hauling of war casualty cases, made necessary by the Hun's taste for hospital bombardment, brought about the development of a number of improvements in ambulance design. A British type of body, mounted on a chassis slightly longer than standard, was fitted with a flatter style of spring than usual, similar to those used in railway practice. A pneumatic system of suspension was adopted on some models, consisting of a rectangular cylinder, 12 by 14 in., like a box with a sliding cover, containing a strongly reinforced pneumatic cushion of rubber and canvas. This took the place of elliptical springs and shock absorbers, giving a vertical play of four inches and proving quite satisfactory in tests. Two tiers of stretcher rails in the body accommodated four army stretchers at once, with space under the seats for unused stretchers or seat cushions. The attendant's seat and locker are at the front, where he can speak to the driver. Ventilators are provided in the roof.

SMALL AIR WASHER FOR USE IN HOME OR OFFICE

An air washer and ventilator has been designed that is approximately the size and shape of a cabinet phonograph. Being compact and portable, it may be used in any office or factory which is supplied with water, heating, and electric-light connections. Enameled in any desired finish, the machine will be inconspicuous among the furniture of a private home. The air is drawn from outdoors, through a spray bath, past a radiator, and is expelled by a variable-speed, motor-driven fan, at a maximum rate of 20,000 cu. ft. per hour.



WAR DIRIGIBLES OF THE BRITISH NAVY NOW



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The Armistice Revealed British Dirigible Construction at Its Height. The Large Ship Illustrated is Supported by 1,000,000 Cubic Feet of Gas, but It is Announced That a Dirigible Now Building will Have a Capacity Ten Times as Great

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Women Workers Contributed Much to the Success of the British Dirigible Program. Two Girls Employed on the Inside are Shown Using the Only Entrance to a Finished Bag

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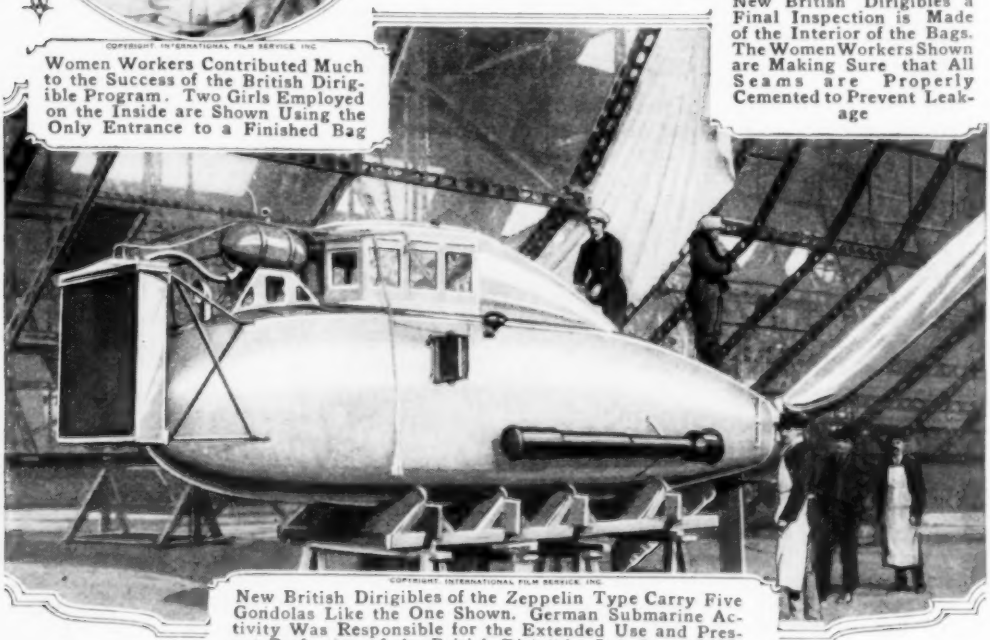
Before Inflating the Giant New British Dirigibles a Final Inspection is Made of the Interior of the Bags. The Women Workers Shown are Making Sure that All Seams are Properly Cemented to Prevent Leakage



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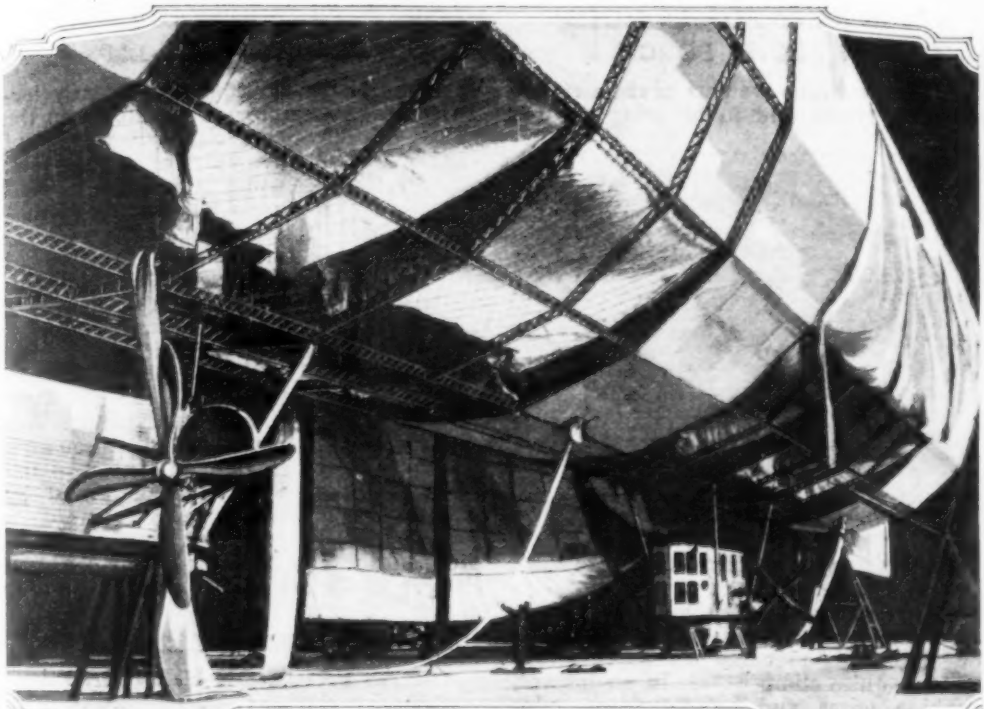
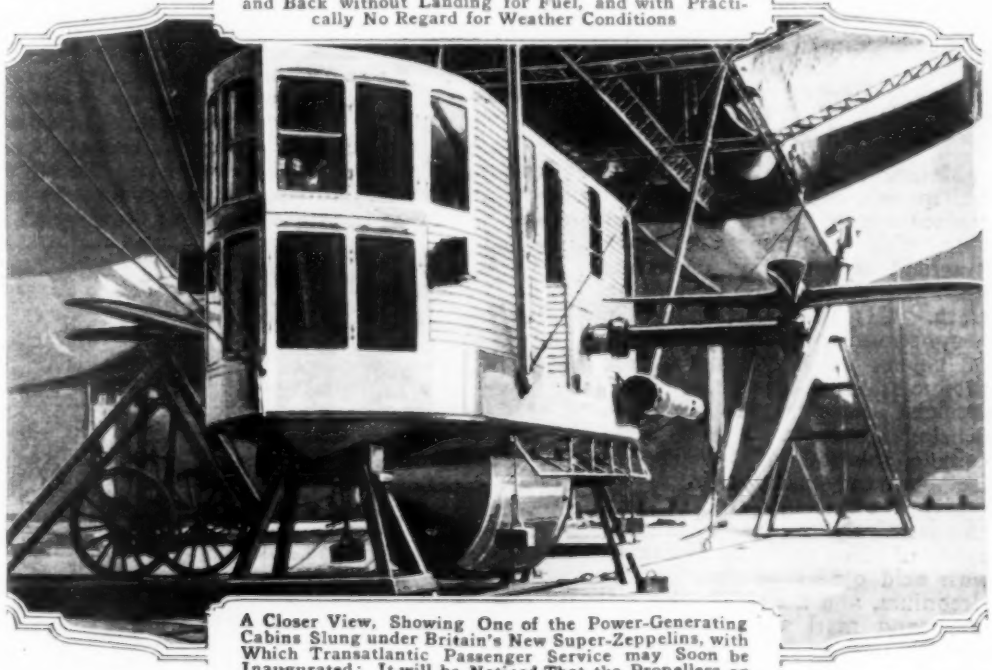
New British Dirigibles of the Zeppelin Type Carry Five Gondolas Like the One Shown. German Submarine Activity Was Responsible for the Extended Use and Present Perfection of the British Dirigible. It is Stated That No Ship was Ever Sunk While under Escort from the Air

READY FOR POSTAL AND PASSENGER SERVICE



The Outer Coverings have been Partly Removed from This British Dirigible, Showing the Rigid Frame and Separate Gasbags. It is Stated That a New British Airship with a Length of 665 Feet can Travel to America and Back without Landing for Fuel, and with Practically No Regard for Weather Conditions



A Closer View, Showing One of the Power-Generating Cabins Slung under Britain's New Super-Zeppelins, with Which Transatlantic Passenger Service may Soon be Inaugurated: It will be Noticed That the Propellers on This Cabin Are Adaptable to Either Driving or Elevating

AIRPLANE BURIES NOSE IN FRONT PORCH

Quick decisions are part of the airman's stock in trade, and in effecting a tardy take-off from a muddy field, this pilot had to choose between a row of interested spectators in automobiles, and the telephone wires. He decided for the latter, nosed his machine up quickly, but couldn't quite climb over. In an instant, machine, wires, and two telephone poles were across the street and on the ground. The airman stepped out unhurt, but the tenants of the house, who were sitting on the front porch when their yard was thus invaded, suffered some nervous shock.

The Pilot of This Machine Chose between Spectators and Telephone Wires with the Result Shown. Losses Included One Wing, One Propeller, and a Pair of Landing Wheels

MANY SUBSTITUTES REPLACE EUROPE'S BROKEN GLASS

Materials of many kinds, more or less transparent, are being tried in Europe to replace window glass, which is unobtainable. Cellulose films are made practical by mounting on metal gratings, light wire screen, or cloth. Glue interlaced with hemp strands between two sheets of paper; albumen and casein products; sheet gelatin, and an artificial resin made by condensing phenol with a formaldehyde solution, all are imperfect but ready makeshifts. More nearly resembling glass, but comparatively expensive, are an oxide of silica made by fusing it with acid oxides of titanium or zirconium, and a combination of greensand marl with magnesia, bauxite, and an alkali, melted in an electric furnace. Some of these glass substitutes are flexible.

CONCRETE ENGINEER RECORDS RESULTS ON FILM

An authority on concrete recently lectured to an assembly of engineers on the methods and results of five years of experiments, using two and a half reels of moving-picture films to illustrate his remarks. One section of the film was unusually interesting, as it showed a slow "setting" process that necessitated the use of a motor-driven camera to record the 50 days' continuous exposure. Explanation and discussion of interesting bits of the film were permitted by the employment of a projector that could be stopped for any length of time with no danger to the sensitive film.

FARMER'S FOE, CARRION CROW, HAS PRICE ON HIS HEAD

Though many of the agriculturist's ancient aversions have been changed to amity, against the carrion crow the old charge still stands; he is the destructive, black-hearted Hun of the fields. To decimate his ranks, always a duty, is now to become also a pleasure and a game. Farmers and sportsmen will line up together this year in a national crow-shooting contest, in which gold, silver, and bronze cups, and buttons will be awarded to the most successful hunters. There promises to be a run on the store supply of crow calls.

One Gun, One Morning, 25 Crows—That Helps to Reduce the Farmer's Menace. A Common Crow Call Brings Them In, and the First One Killed is Set Up as a Decoy

COMMENT AND REVIEW

[These pages were printed March 24, 1919]

The Transatlantic Air Voyage

EVEN before this page can be printed and reach its readers, there is a chance that the first transatlantic air voyage will have been made. France was the first to announce an attempt, which unfortunately had to be deferred, owing to a cracked cylinder. England is working desperately to get an airship ready, and it is understood our own War Department has hopes also of being the first across. It is to be hoped the feverish anxiety, though quite natural and commendable, will not lead either of the contestants to undertake the trial until every possible effort has been made to insure success. There are dare-devil "airnats" in plenty ready to make the attempt even in the face of a minimum of chance of success, but let us hope that success is guaranteed in advance, so far as such a thing is possible.

Crossing the Atlantic in a plane today really seems less of an undertaking than crossing the English Channel did at the time Blériot did it for the first time. There is a great difference in the two flights, however, even after allowing for the improvement in air craft since that day.

As the birthplace of the aeroplane, it would be most gratifying to Americans to have the honor of the first flight, which will be an epoch in history deserving a place alongside the first locomotive and steamship. Our conduct of aeroplane affairs, however, ever since Wilbur Wright made his first flight, does not warrant any great expectations. We hope to win, but shall be very proud of the Frenchman or Englishman who carries off the honors.

There is doubtless no other one thing of a commercial nature which seems to combine so many unknown possibilities for good and evil as the trans-ocean airplane. With its accomplishment, which apparently is assured, we become the next-door neighbors of the other nations of the world, with the same liability of interference. The oceans, once our confident bulwark from attack, no longer protect; and when the air becomes an international thoroughfare, we can no longer hold back, we can only defend. With the air definitely conquered, the world becomes practically a city block; and with so great a decrease in immunity, let us hope for a corresponding hesitancy to start a conflict.

The theories as to air currents and atmospheric conditions, favorable and otherwise, which the first flight will reveal, are many and conflicting. The probability, however, is that the voyage will show less difficulty from these sources than expected, and will more likely be reduced chiefly to engine performance, which, like other mechanical details, is capable of correction and improvement.

And so the next few months will bring events of as thrilling interest as any battle of the war, and likewise fraught with possibilities no less portentous and momentous.

An Encouraging Prospect

SPRING is here and with its advent has come a most encouraging resumption of peace-time activities. There are spots, like New England and the upper Mississippi Valley, which have responded less freely, but these, too, will shortly fall in line.

The boys back from France, who were on the firing line on that memorable eleventh day of November, tell of the remarkable sensation which came when the big guns were suddenly hushed, and the quiet that followed which was almost painful in its intensity. It was many hours before the men were able to adjust themselves to the new condition. The industries of our country experienced a very similar state, with this difference: Where the individual was able to bring himself to the readjustment in a few hours or days, business, by reason of its greater complications, has required five months. Even at that, the period has been surprisingly short.

This does not mean that we are back on a peace basis by any means, but it does mean that the wheels of activity have already begun to turn, and each day means a speeding up of those already started, and more and more of others.

Not all the men who have returned to civilian life have yet been able to place themselves as desirably as when they left to enter war service. The assimilation is rapidly progressing, however. In some concerns, many of the female workers, instead of being discharged when soldiers returned to their former positions, are

being retained by the same employers in other positions. When we consider the tremendous upheaval and disarrangement of established working conditions, the marvel is that readjustment has progressed as far and as rapidly as it has. An employed, busy nation has the main essentials for contentment, happiness, and prosperity, and our outlook is assuredly a most inviting one. The crop prospects are unusually good, with a certain demand at good, though reduced, prices for all foodstuffs both at home and abroad. There will be a sure market for everything we can raise this year, and the essentials for home gardens and intensive production are almost as important as a year ago. With the former restrictions as to the free use of foodstuffs removed, it would be a pity if we returned to the needless and criminal waste of former years.

ONE statistician has estimated that there are in this country today constructive expenditures totaling five billion dollars, which are hesitating to begin on account of the high prices of materials and labor. It is evident that an individual or corporation is reluctant to erect a building which today will cost him $100,000, if he feels that six months or a year hence he can duplicate the same identical structure for $60,000 or $70,000. However, there is a certain patriotic element in all this, and if everybody waits for the bottom price, we will all suffer from the inevitable stagnation, and complete resumption will be indefinitely postponed. The policy of the founder of the Rothschild banking house, which was to buy securities neither at the lowest price, nor to sell at the highest, and which the baron demonstrated so successfully, is not a bad one just now. There is, moreover, the probability that a building, erected at more than the normal cost, may furnish the opportunity for conducting, for some years at least, a business at profits which will warrant the unusual expenditure. There is always a "happy medium" somewhere between the abnormally high and abnormally low, which is usually difficult of determination, but which is warranted and advisable.

Normal Prices Returning

Some building materials have already fallen in price; a substantial reduction in many others will doubtless produce greater profits at the end of twelve months, by reason of increased sales, or sales which would otherwise not be made at all, than by trying arbitrarily to maintain war prices, which is ultimately impossible. The Sales Department of the War Department, which has the disposal of hundreds of millions of dollars of raw and manufactured products, bought for war purposes and no longer needed, has already arranged for the release of certain commodities. The lumber associations have been authorized to commence the sale of the vast quantities of lumber on the Government's account and expect to clean up the entire surplus in six months. The copper interests, representing 90 per cent of the American producers, expect to dispose of the Government's holding of copper in fifteen months, or less. Sodium nitrate and hardwood lumber are also now ready for release. Other lines will follow as rapidly as arrangements can be made, and all without "breaking" the market, though prices will naturally be less than war-time prices. A fair start has been made toward settlement with the thousands of contractors and subcontractors, although the process is less rapid than could be desired. On the whole, we are recovering from conditions of the "day after" quite as rapidly as should be expected.

AS a prelude to her attack on civilization, Germany did two things. For forty years she built up a vast military machine at home, and for forty years, through well planned and skillfully executed propaganda throughout the world, she taught the gospel of her superior efficiency. This latter to such an extent and so successfully that, by 1914, to use an expressive though slangy expression, she had the world "buffaloed."

Undue Credit to Germany

This is not to say Germany was not efficient, nor superlatively organized, for she was. Not only was the theory of efficiency talked on every occasion, but it was demonstrated in her manufactured products and the thoroughness of her immense export trade. If a German manufacturer could not compete in any foreign port with any article made elsewhere, his government promptly came to his relief with lower ocean freight rates, or some other form of subsidy. The natural

result of all this was to create and foster a world-wide conviction that Germany was a supernation, head and shoulders above all others, and therefore impregnable. To resist Germany when she set out to conquer was to invite and insure disaster. In short, the expectation was to destroy in advance a world morale, and thus reduce successful conquest to its simplest terms.

This system was not without its results and effect. The German at home, and with few exceptions abroad, was absolutely grounded in the conviction that the fatherland was invincible. We can each recall those Germans in this country, including those who had been naturalized here for many years, and who eventually took sides with the United States against Germany, who in 1914, 1915, and 1916 were both indignant and angry at any suggestion of German failure, or of responsibility for starting the war.

It is quite true that, in the early days of the struggle, victory perched on German banners, and the tide of battle flowed one way. This apparently was proof of the claim of supernation. What with millions of men with years of the most severe military training; guns with undreamed-of range, throwing shells of unheard-of size; new explosives of unequaled power and violence; airships; submarines; gas shells; liquid fire, and all the other new-in-civilized-warfare weapons, the claim apparently was established. The world seemed voiceless to refute the assertion.

Then gradually—so slowly at first there seemed no progress whatever—the allies began where Germany had commenced forty years ago, to gird up their loins. It was slow work—that of fighting a defensive battle against vastly unequal odds with one hand and building an offensive with the other. The conditions were supremely hard, for it is one thing to plan and invent and experiment and construct and test out, all under the conditions of peace, and quite another to commence at the foundation to do the same when carrying on a war.

In only a little more than four years, the allies had searched out and organized their inventive and scientific minds, their chemists, their builders of guns and submarines and air craft, and had brought their fighting machinery—with the exception of the 76-mile gun—up to the standard which Germany had required forty years to accomplish, and in some respects had gone even better. With the advent of the United States came a tremendous impulse of inventive accomplishment which in scarcely more than a year had conceived, and made in vast quantities, weapons in comparison with which the German type was as a child's toy.

Many of these things are still a secret in the archives of our War College; their details or even their existence have not and should not be made public; but it is permissible to mention one, a gas shell, the use of which will absolutely and almost instantly annihilate any army into whose ranks it is hurled.

Had the armistice been delayed only a few days, there would not have been left alive a single soldier in all the Metz fortifications. A few planes hovering so far above its guns as to be mere specks in the sky; a few gas bombs dropped among the forts, and a few moments later, not a living soul left to challenge or surrender. And this shell, the result of only a few months' effort, makes the German preparation of forty years as the snail is to a hare.

These words are not written for the purpose of any self-laudation of what the allies accomplished chiefly in thirty-six months, although deserved. History will emphasize this fact far beyond what the most of us realize today. The essential thing we should grasp is, not to permit ourselves to accept in future as we have in the past, without question, what is declared to us by Germany, for there is every reason to believe that a country which found its deceptive propaganda so profitable in years gone by is not going to abandon its formula when we once more settle down to peace conditions. We may, with equal advantage, each one for himself, question the integrity and motive of many statements which are made with so much assurance, and which we meekly accept without any other proof and authority than that of the speaker's word. If what we are urged to believe is so, it is capable of proof; if the evidence does not support the statement, we simply delude ourselves.

Does anyone imagine that, if the German people who were alive on that fateful August day, 1914, could have known what is known now, they would have gone into the war?

H. H. WINDSOR

VICTORY OF PRINCETON COMMEMORATED

A sculptured group, 26 ft. in height, will stand at the base of a 50-ft. shaft to be erected on the green at Princeton, N. J.

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This Figure of Washington will be Erected on the Scene of a Victorious Surprise Attack during the Revolutionary War

The event commemorated is the surprise attack made here at daybreak, Jan. 3, 1777, on a part of Cornwallis' forces by the patriot army. The engagement was fought stubbornly, but the Americans finally triumphed, thus ending a long series of discouraging misfortunes, and inaugurating the campaign which drove the British from nearly all of New Jersey.

THREE MESSAGES AT ONE TIME ON ORDINARY TELEPHONE

Even the multiplex telephone, announced in Popular Mechanics last March, isn't wholly new in its achievement. It is related that a Brazilian newspaper has been enjoying for some time the privilege of carrying on three simultaneous conversations over a single, ordinary telephone circuit. With three telephone sets at each end of the line, one pair of users talks English, one pair French, and one pair Portuguese. Out of this polyglot complex, which the telephone diaphragm triumphantly passes on, the listeners seem to find no difficulty in selecting the sounds intelligible to them and ignoring the others. The newspaper people express great satisfaction with the result, especially as they pay for only one line.

SEAPLANES FOR FOREST-FIRE PATROLS

"Seaplanes for Forest-Fire Patrols" reads like a printer's blunder, but it really represents a movement now on foot in Canada and northern Michigan. The value of aerial observation in conserving our valuable timber reserves is evident; and the necessity for the use of seaplanes becomes so when a map is consulted. It is revealed that hundreds of lakes dot the territories the airmen would patrol, thus furnishing ideal landing places for small flying boats. Many former forest rangers from both sides of the international boundary have become military fliers, and, on discharge, should furnish an excellent nucleus for a service of this sort.

SAILORS IN MERCHANT FLEET HAVE OWN UNIFORM

Gobs on the Shipping Board's training vessels now have uniform markings of their own. Instead of the regulation three narrow white stripes on the blouse collar this merchant sailor wears two broad ones. The Shipping Board insigne on the blouse pocket is most distinctive, however, as nothing of the sort is worn in the navy.

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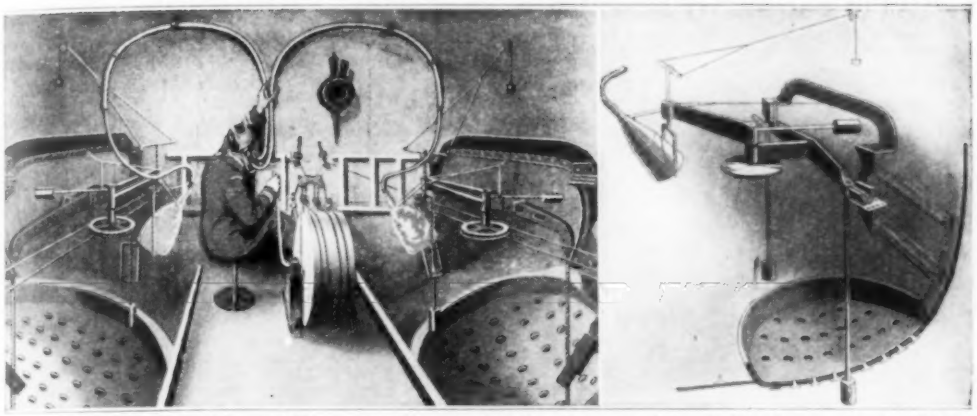
¶A great shortage of magazines, for the use of soldiers in camps and hospitals, is reported by the American Library Association. Recent issues of magazines not bearing the "one cent notice" on the cover usually may be sent through the local library. The May Popular Mechanics bears the notice, however, and may be forwarded through the mail if a one-cent stamp is affixed.

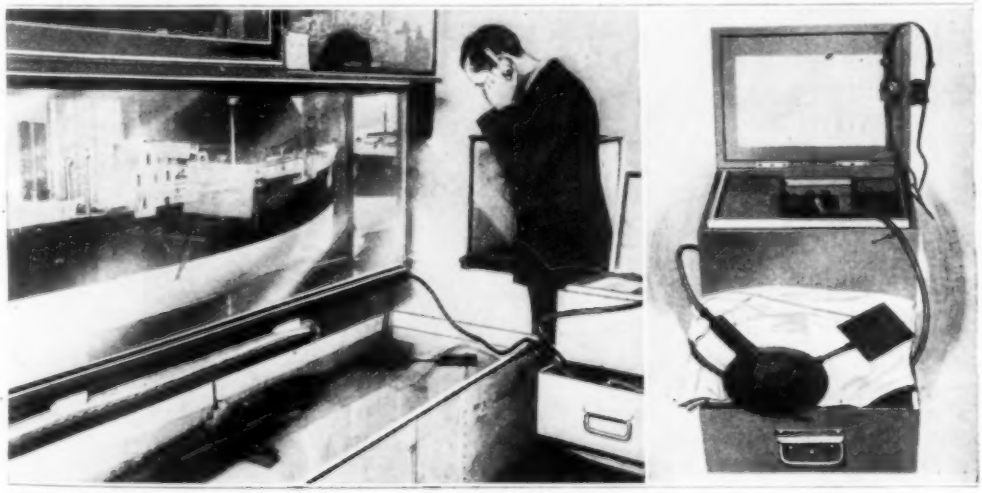


The Observer's Use of Sound Trumpets, Direction-Finding Drum, and Small Diaphragms in the Ship's Sides is Made Plain by the Left Picture. The Diagram at the Right Indicates How the Parts are Correlated for the Detection of Enemy Submarines

HYDROPHONES ON SHIP DETECT PRESENCE OF ENEMY CRAFT

Water transmits sound better than air, and instruments for locating submarines which made use of that fact were most successful. One French device that did splendid work took the form of a rounded projection or "blister" on the ship's hull below the water line, one on each side replacing a section of the plating. Numerous perforations in these convex iron plates were closed by diaphragms. Inside the ship sound-collecting trumpets were suspended, facing the concavity of the "blisters." These were connected by tubes to earpieces in the observer's helmet. When the telltale vibrations were heard, the trumpets were swung to different angles by turning a drum. At the point of loudest sound, graduations on the scale indicated the direction of the disturbance with great accuracy. Another successful device, electrical in its nature, resembled a magnified dictaphone. It was not a part of the ship, but was placed in any selected location.

¶To reduce army overseas foodstuff reserves to 45 days' supply, large sales have recently been made to the French and Belgian governments, the strongest demand being for evaporated milk.



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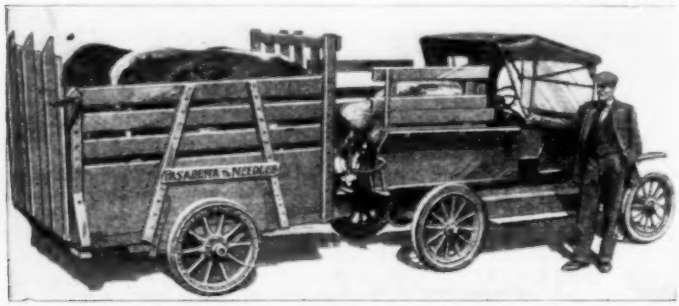
At the Left a Working-Model Submarine is Revealing Its Approach by Sound Waves Heard through the Device, Like a Big Dictaphone, in the Corner. The Right View Is a Close-Up of the Microphonic Detector, Which is Placed against the Side of the Ship

CATTLE RIDE TO MARKET IN AUTOMOBILE TRAILER

An enterprising cattle dealer who lives far from town takes his cattle to market in a vehicle of his own design. Two 1,000-lb. cows travel safely in a stout trailer, with no stops for meals. Dining-car service is furnished by the back of the auto, carrying hay which the animals can easily reach through an opening in the trailer body. As a result of the quick trips thus made possible the cattleman expects a larger income this year.



These Cows Make No Stops for Meals for There Is Plenty of Hay within Reach on the Rear End of the Automobile. The Cattleman Reports Quick Trips and Larger Profits

ARMY TRAINING PLANES TO BE STORED

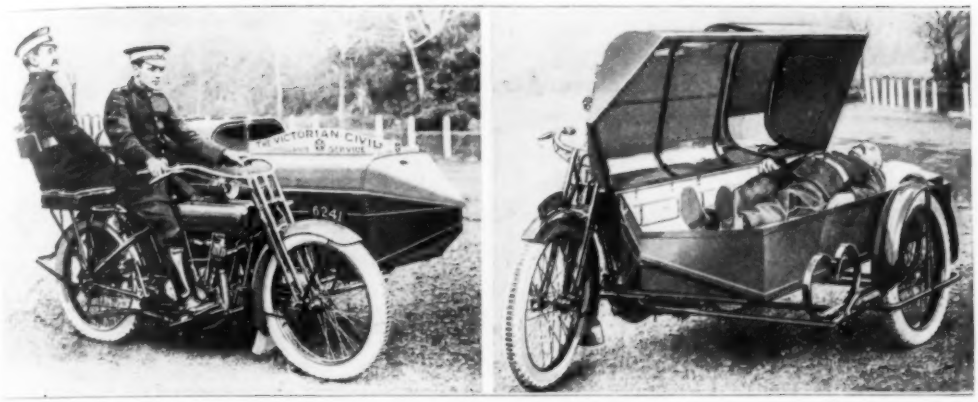
As part of the return to a peace-time military basis the War Department has decided to retain 16 flying fields and three balloon fields, using only two for actual instruction purposes. Many elementary and advanced training planes will thus be superfluous, but it is believed that there is no immediate prospect of radical change in airplane design, and that the planes may be stored for a number of years without danger of deterioration.

MOTOR-TRUCK PLOW CLEARS HIGHWAY OF SNOW

To turn a five-ton motor truck into an efficient snowplow requires some ingenuity, but officials of a Montana county solved the problem and have kept their highways passable to automobiles all winter. First, cleats are bolted to the truck's rear wheels for traction. Then wooden runners with half-inch steel edges are fastened to the front wheels. A V-plow of sheet-tin plate on a 2 by 4-in. timber frame is bolted to a heavy beam on the front of the truck. A six-inch mast at the plow point is used to raise and lower the point by tackle from the truck body. From the sides of the body spreader boards angle out, to smooth away the snow piles left by the plow; these also are adjusted by block and tackle.

Snowplow Attachment for Motor Truck: Observe the Spreader Boards, Runners on Front Wheels, and Mast for Adjusting Point

Rear View Gives a Better Idea of the Work Done by the Plow Point and Spreaders. The Traction Cleats on the Rear Wheels May be Seen Here



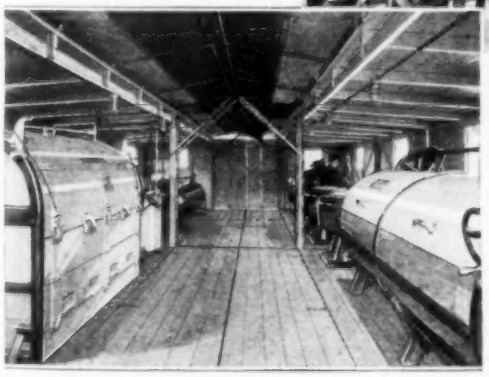
This Comfortable Motorcycle Ambulance Carries a Hospital Attendant and a Surgeon to the Scene of the Accident. The Sidecar is Fitted to Receive the Stretcher, Thus Causing the Sufferer a Minimum of Discomfort

SIDECAR AMBULANCE FOR HURRY CALLS

Motorcycle ambulances saw some service on European battle fields, but it was left to an Australian city to develop the machine for civil use. The only radical departure from usual sidecar construction is in lengthening the chassis to give more spring suspension for the long car, and in mounting the third wheel between two sets of perpendicular opposed coil springs. To secure further comfort for the patient, the stretcher is made removable; a hinged, ventilated top is provided, and a tandem seat is added in the rear to carry a surgeon or nurse.

STEAM LAUNDRY FOLLOWS MARCHING TROOPS

An efficient mobile laundry unit furnishes another example of government war-time enterprise. Hauled by a tractor in a train of four cars, at a speed of three and a half miles per hour, the establishment may be assembled and ready for work in 20 minutes, or disassembled and ready for the road in 15. Thus it is enabled to follow marching troops and function where most needed. Assembled, the working space is about 20 by 24 ft., giving ample room for the modern appliances used. Steam for washing, as well as power for the machines and the lighting dynamo, are supplied by the same tractor that pulls the train. It is claimed that the work done by this compact little plant excels that of many small-town laundries of twice its size.



This Is the Interior of the Military Laundry That can Follow Marching Troops. The Exterior View, Above, Shows How the Four Sections of Which the Laundry is Made Up are Assembled, and How the Power is Applied to the Washing Drums. The Inside Space Measures About 20 by 24 Feet, Giving Ample Room for Machinery and Workers

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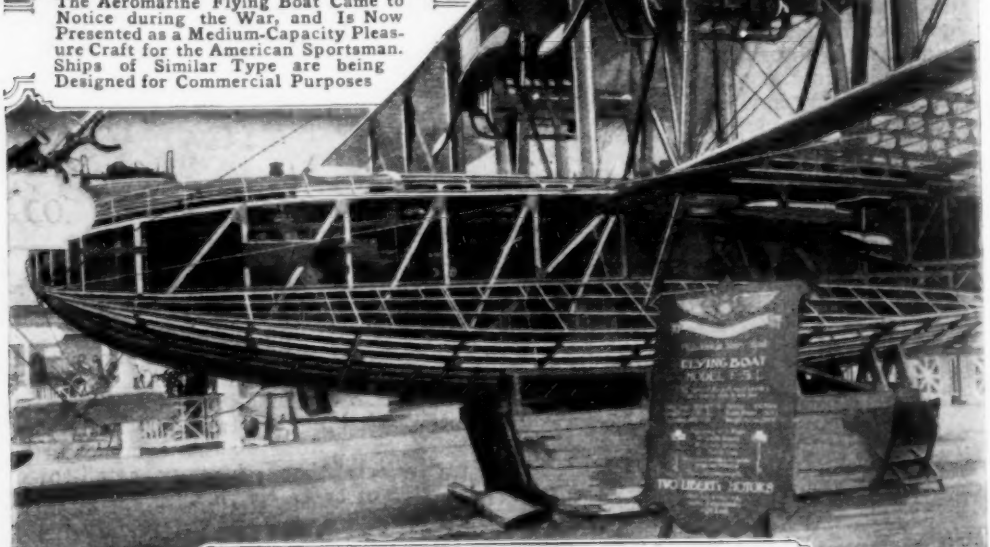
¶Official warning is given that the American army gas mask, designed for protection in the open air against a few specific gases, is useless for the majority of commercial and industrial purposes.

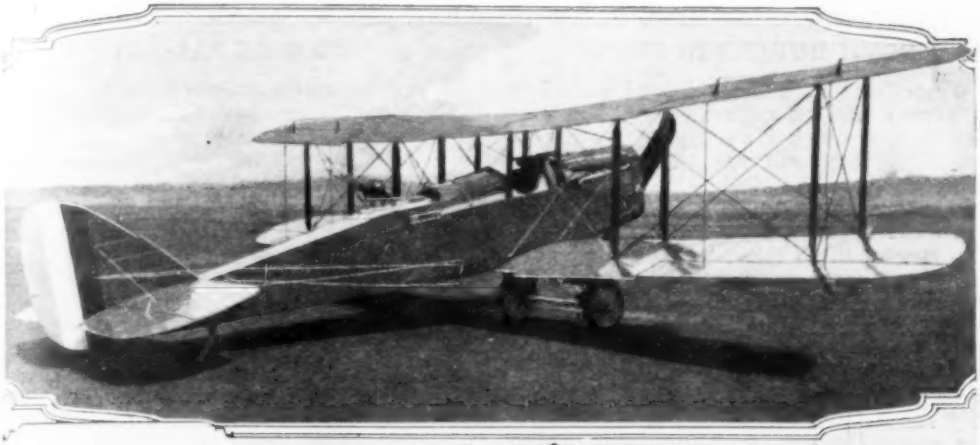
SEVERAL INTERESTING TYPES OF AMERICAN

The La Pere Two-Seater, a 39-Foot Span Liberty-Motored Biplane Developed Late in the War for the Government: It Bears the Name of Its French Designer and According to Some Reports Has a Ground Speed of 136 Miles an Hour

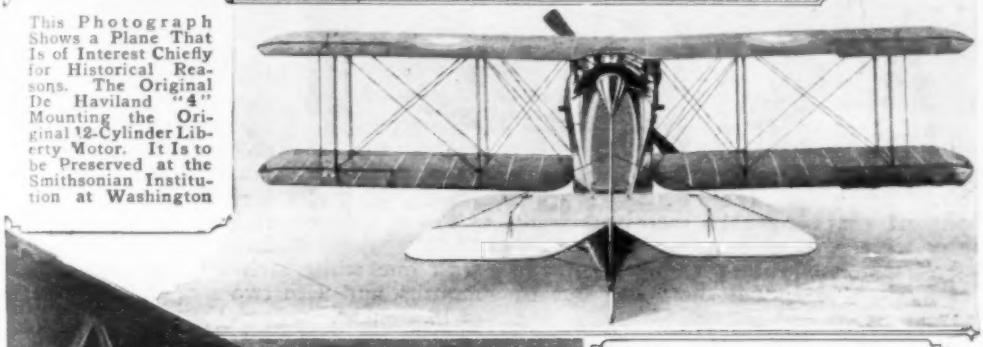
The Aeromarine Flying Boat Came to Notice during the War, and Is Now Presented as a Medium-Capacity Pleasure Craft for the American Sportsman. Ships of Similar Type are being Designed for Commercial Purposes



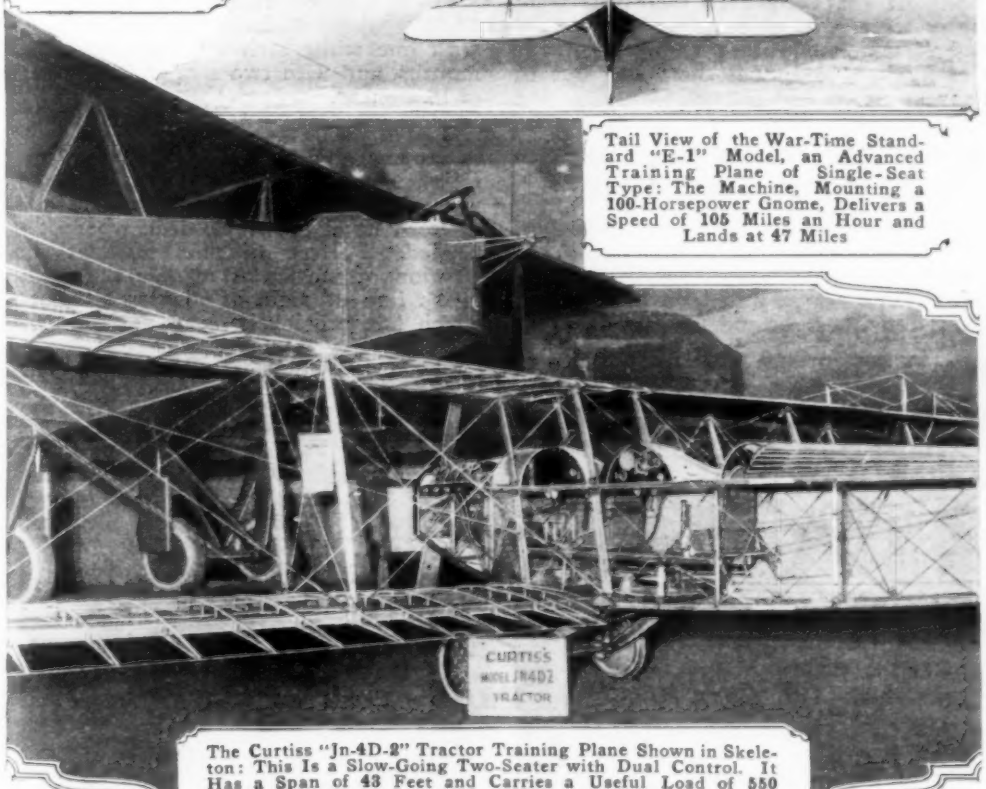
The Dual-Motored Flying Boat "F-5-L", as Used by the Navy during the War, is Here Shown in Skeleton. The Picture Gives a Fair Idea of Some of the Structural Features of Such Craft. Boats of This Type were Employed for Patrol and Convoy Duty in the War Zone



This Photograph Shows a Plane That Is of Interest Chiefly for Historical Reasons. The Original De Haviland "4" Mounting the Original 12-Cylinder Liberty Motor. It Is to be Preserved at the Smithsonian Institution at Washington



Tail View of the War-Time Standard "E-1" Model, an Advanced Training Plane of Single-Seat Type: The Machine, Mounting a 100-Horsepower Gnome, Delivers a Speed of 105 Miles an Hour and Lands at 47 Miles



The Curtiss "Jn-4D-2" Tractor Training Plane Shown in Skeleton: This Is a Slow-Going Two-Seater with Dual Control. It Has a Span of 43 Feet and Carries a Useful Load of 550 Pounds. A Large Percentage of America's Army Pilots Received Initial Instruction in Machines of This Type

TRAIN AND RESCUING PLOW BOTH BURIED IN SNOW

Passengers on a Rock Island train last February had an experience with snowdrifts in western Kansas that they will remember to tell to their grandchildren. In a deep cut between Phillipsburg and Prairieview the train headed into a drift on a black night, with a 60-mile gale blowing. By morning the train was completely buried in snow. A snowplow, which set out to the rescue, valiantly attacked the huge drift; but it soon got stuck, and the flying smother of white covered it also. Train and plow were shoveled out by hand 24 hours later. Some of the drifts of that unusual storm were 30 ft. deep, and farmers and other residents of the vicinity had to tunnel their way out of their houses.

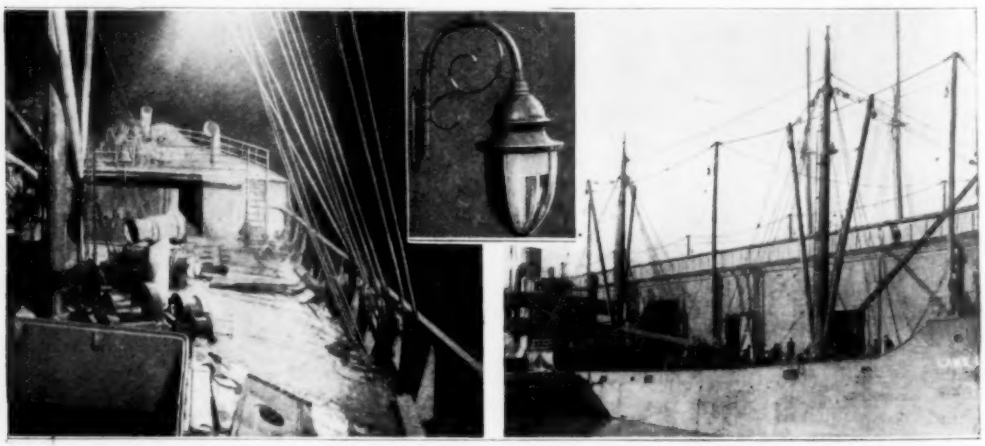
One could Never Tell It, but the Man in the Picture is Standing on Top of a Locomotive Cab. The Whole Train Is under the Snowdrift, as Well as a Plow That Went to Its Rescue

RED CROSS WORKERS RECEIVE SERVICE BADGES

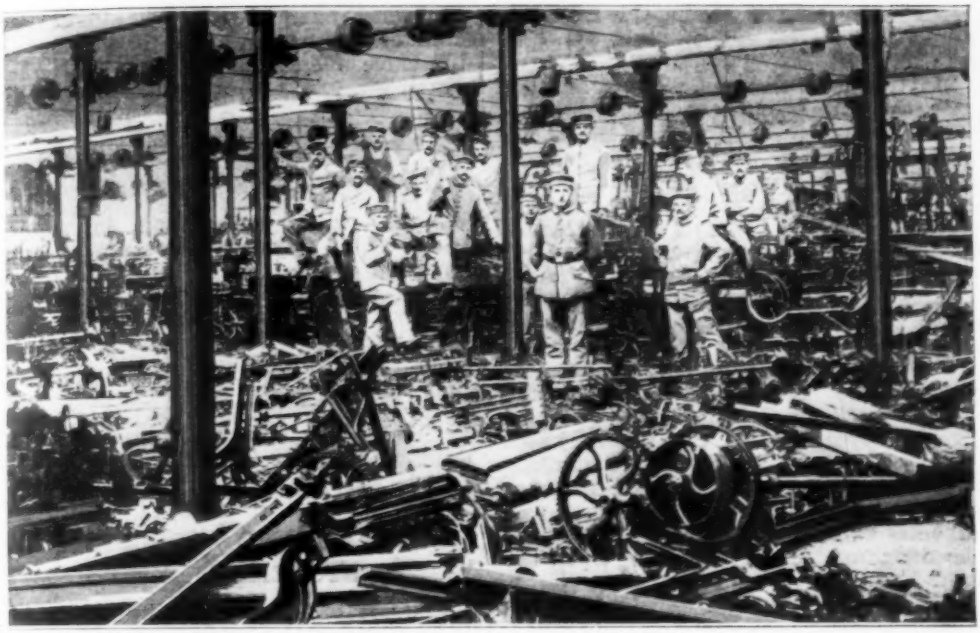
The men and women of the American Red Cross now have their distinctive badge for service in war time. For men, the emblem is a button for the coat lapel; for women, a similar but larger disk is hung by a blue ribbon to a bar with safety catch. The design of both is the same, however, consisting of the Red Cross on a white background, surrounded by a band of blue on which are inscribed the words "Service, American Red Cross." The women's badge has the added feature that the color of the ribbon announces the length of service. The plain blue ribbon denotes 800 hours in six months; with one white stripe, 1,600 hours in 12 months, and with two stripes, 2,400 hours in 18 months.

FLOOD LIGHTS ON SHIPS' DOCK MAKE NIGHT LOADING SAFE

One of the docks at South Brooklyn, N. Y., has lately been equipped with 14 powerful electric lamps, seven on each side. They are mounted on poles 60 ft. above the pier floor and far enough apart to range the entire deck length of a large freight ship. The dock side of each lamp is masked, so that all the illumination is directed upon the ship's deck where it is needed. Perfect diffusion of light and location of the lamps outside the workmen's line of sight eliminates all glare, which has previously been the cause of



New Form of Light for Ship Docks: The Insert Shows the Lamp in Detail, While, at Left and Right, Are Views of the Installation on a Brooklyn Pier, Indicating Strong Illumination of the Ship's Deck



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Here Is a Typical Hun Wrecking Crew Busy with Their Sledge Hammers in a French Factory. Germany Took This Means of Creating a Market for Her Textile Machinery

several accidents. The new lamps effectively illuminate a radius of 250 ft., making night loading and unloading operations as satisfactory as day work.

DAYLIGHT EXACTLY MATCHED WITH POLARIZING DEVICE

When a scientist desires to secure an exact reproduction of daylight from artificial sources, he generally uses screens or light filters. A method recently developed makes use of the Nicol prisms of a polarizing apparatus. Crystalline quartz is placed between the crossed prisms, its thickness and the angle of the adjustment being varied according to the nature of the artificial light. Using this equipment, an accurate imitation of daylight is obtained. The method, however, is obviously limited to the illumination of comparatively small areas.

DOUBLE PURPOSE PROVED IN GERMAN VANDALISM

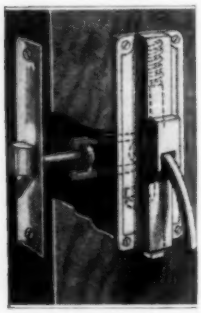
The expression "wanton destruction" is often employed to describe German methods in Belgium and northern France. But the terrific wrecking of industrial life in these countries was not "wanton"; it was the result of deliberate, careful calculation, which intended not only the annihilation of French industrial life, but also the use of German machinery in reconstruction. Thus, after discussing the havoc wrought in France, a German report goes on to say, "If the commercial relations between France and Germany [after the war] are sufficiently favorable, an opportunity of tremendous importance, notably the erection of German textile machinery, ought to offer itself in northern France."

SHIPS' DOUBLE BOTTOMS PUT TO WORK

For many years a few steamships from the Far East have brought fuel oil back to Britain in the ballast space between their inner and outer hulls. The practice never became general, however, and "tankers" continued to handle the bulk of the trade. But in June, 1917, increased submarine activity and the expansion of the allied fleets made immediate additions to tank tonnage so imperative that not a few, but hundreds of British and American "double bottoms" were fitted for this auxiliary cargo. Apart from its war-time results this new practice has taught marine engineers many lessons that will guide them in designing the oil-burning ships of tomorrow.

IMPROVEMENT IN DOOR LOCKS TO PERMIT HURRIED EXIT

Exit doors of theaters, schools, and like gathering places, must normally be kept locked, and are therefore of little avail in case of panic, unless specially designed locks are provided which open the doors upon pressure from the inside. A recently marketed device of this kind has a pivoted plate curving outward and downward at the point usually occupied by the door knob. Voluntary or involuntary pressure against this plate actuates either an ordinary form of lock or a pair of bolts arranged at top and bottom of the door, immediately throwing open the exit.



WHEEL TRACTION IMMATERIAL TO TRUCK WITH WINCH

Slippery, hub-deep sand and semiperpendicular grades had no terrors for a motor truck, of which several army models, were made, equipped with a winch mounted behind the rear axle on an extension of the frame. When the end of the cable from the winch was attached to some solid object the truck progressed backward over or through almost any kind of surface. With its brakes locked, the cable and winch served to pull other vehicles across the same difficulties.

Rear View of Motor Truck Equipped with Winch, Which is Seen in Position on an Extension of the Frame: The Incased Driving Gear Is Visible Just above the Winch. The Cable, as may be Seen, Pays Out behind the Truck

CAFETERIA PLAN SELLS WOMEN'S APPAREL

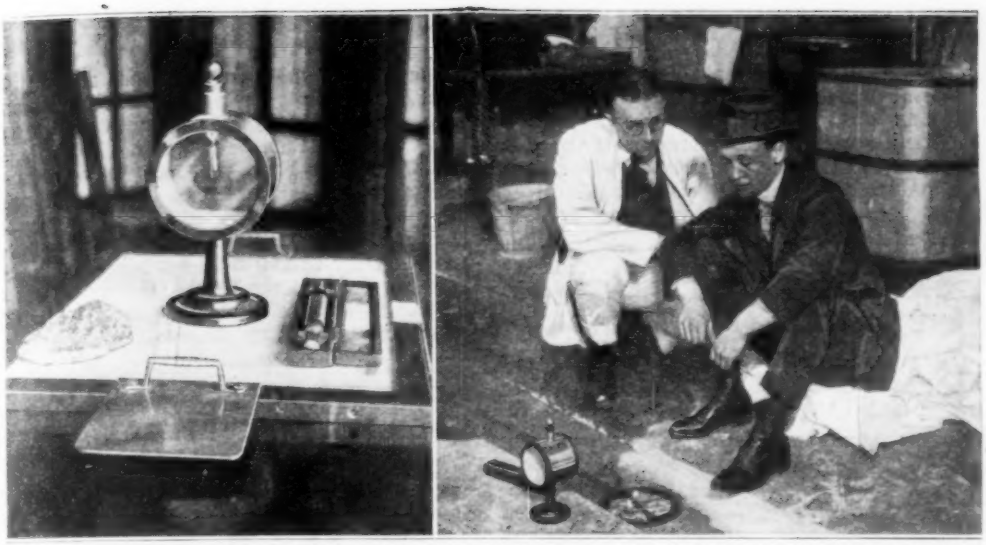
Signs replace salespeople in a city "dresseteria" now successfully selling women's ready-to-wear clothes. Unattended and unhurried, the customer examines the articles in which she is interested and makes her purchases. She may have help, however, as a sign informs her that an employe will be glad to assist in selection if invited to do so. Her choice made, the customer turns to a central desk, where the sale is concluded and the bundle wrapped.

WIRE AND WIRELESS SYSTEMS LINKED

Conversation between a city home with ordinary telephone equipment, and an airplane in the clouds above it, is forecast by a reported method for connecting wire and wireless systems. The originators do not believe that wireless telephony will ever supplant the present wire system entirely, but they hold that it has its use in communicating with ships, moving trains, islands, and inaccessible places in general.

GOVERNMENT BACKS GOOD-ROADS PROGRAM

The desire of many state-highway officials that oversea road engineers be returned to their jobs in this country is another evidence of the growing demand for more and better roads. Despite present costs of road-building material and labor, it is expected that a total of more than half a billion dollars will be spent for this purpose in the next year and a half, giving work to more than 100,000 men in addition to those employed in the production of materials. The Federal share of this program already is assured by the passage of the recent post-office appropriation bill by which an expenditure of $209,000,000 for highways is provided.



In the Center of the Left Picture Stands the Gold-Leaf Electroscope, While at Its Right Is the Charging Device in Its Case. In the Left Corner Is a Fragment of Willemite. The Right-Hand Picture Shows the Investigators in Cook County Hospital Laundry, Watching the Electroscope

HUNTERS OF LOST RADIUM USE ODD TOOLS

By PAUL H. WOODRUFF

MAKING a wireless receiving station out of a gold-leaf electroscope; watching the inside of a small, dark box with a microscope; holding a queer-looking mineral fragment close to suspicious lurking places; these are some of the mysterious methods practiced by the professional hunters of lost radium. For with the constant use in busy hospitals of radium capsules no larger than a diamond, and many times more valuable, there are bound to be occasional losses. It is the task of the insurance underwriters to recover the missing particle if possible, and they have learned to take advantage of all its extraordinary properties to make it reveal itself.

Testing a Suspected Washing Machine in the Hospital Laundry with a Fluorescent Screen, After the Electroscope had Quit on Account of Too Much Moisture: The Screen Itself Is on the Front of the Box, and the Observer Watches It through the Microscope

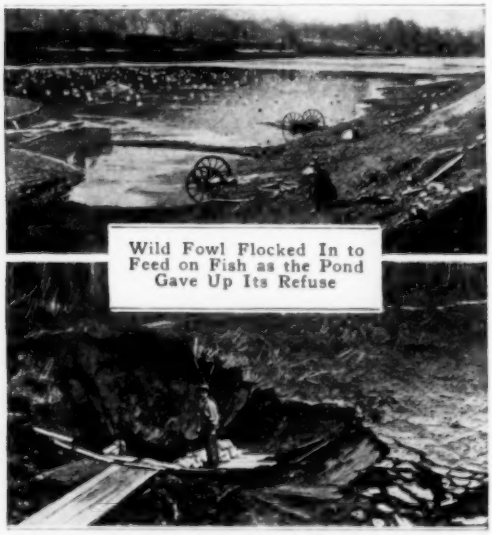
Radium's strange power to discharge a statically charged electroscope, even at a distance of 50 ft., makes that instrument the most important of the radium detective's tools. With it goes a small frictional electrical machine for keeping it charged. The natural sensitiveness of the instrument is increased by suspending an aluminum wire, 10 or 12 ft. long, from its knob, like a wireless antenna. The electroscope's only enemy is moisture, which practically short-circuits it and gives a false discharge signal. This is what happened at Cook County Hospital in Chicago, where a $4,100 radium tube recently disappeared. The hunters thought they had located the tiny treasure in the laundry, until further experiments demonstrated the misleading influence of the humid air.

A fluorescent screen, such as is used in X-ray work, will glow when radioactive emanations fall upon it; so a cameralike box, with a screen on one side and a microscope on the other to catch the faintest glimmer, is

included in the radium sleuth's kit. The mineral willemite, consisting of crystals of zinc orthosilicate, also glows with a brilliant green fluorescence when there is radium within a few feet of it. For that reason it constitutes another of the queer tools devoted to the capture of the escaped speck of fortune.

PURIFICATION OF PARK PONDS BY DRAINING AND SUNNING

Stagnation, followed by the development of malign and malodorous forms of low plant life, is a disease common to



Wild Fowl Flocked In to Feed on Fish as the Pond Gave Up Its Refuse

From Holes Like This in the Lake Bottom, After the Water had been Pumped Out, the Rich Black Muck was Sucked Up and Spread on the Park Lawns for Fertilizer

park lagoons and ornamental ponds which suffer from lack of circulation. When four artificial lakes in the city parks of Los Angeles, Calif., became so afflicted, the park commission resorted to the method of draining them and allowing the purifying rays of the sun to shine upon the exposed beds until sanitation was complete. With the aid of the fire department, the water was pumped from the lagoons into the adjacent sewers until the outflow began to show black with the muck of the bottom. Then the discharge lines were fitted with sprays and turned upon the park lawns, for the potent fertilizing effect of the decaying sediment. A little water was left in each pond for the goldfish; but the wild fowl of the near-by coast soon discovered this inviting cache of delicacies, and the muddy pools became a splashing mass of gulls geese, ducks, pelicans, grebes, and mud hens. Much curious material was brought to light as the water receded, one lake, at Echo Park, uncovering 12 sunken rowboats, two road scrapers, an automobile, a cookstove, a human skeleton, three pistols, and a vast collection of tin cans, bottles, fishing tackle, and other miscellany. After airing and sunning the bottom for four to six weeks, the water was gradually restored, nearly a month being taken for the filling process.

POWERFUL PORTABLE ARC LAMP FOR MOTION-PICTURE WORK

Motion pictures may be taken anywhere and at any time with the aid of a new compact arc lamp of great power, which is so light that a man can carry two of them. A twin arc is used, with two pairs of carbons cored with a compound of magnesia, giving a light closely resembling daylight. The feed is automatic, the solenoid occupying a box at the back of the lamp house. In the same box are two rheostat coils, enabling any standard electrical-supply circuit to be used. A diffusing slide of heat-resisting spun glass closes the front of the case. The lamp is supported at any desired height by a folding iron tripod. Three such lamps are sufficient to illuminate a setting 50 by 30 ft., the candlepower ranging from 8,000 to 15,000 for each.

"EX'S" KEEP ALMANACH UP TO DATE

Since 1763 the German Almanach de Gotha has given the world an annual digest of all data concerning royal families and governments throughout the world, the publishers' manuscript going to the printer in the fall, to appear in book form in the spring. But this year, unfortunately, the material prepared in October, 1918, was discovered to need alarming revision. Thus articles on Poland, Finland, and Ukrainia were canceled, "owing to the change in the course of events," while descriptions of William Hohenzollern and his friends nearly always needed a prefatory "ex." Otherwise the former emperor is allowed to retain his 53 titles without alteration.

¶Copper-oxide deposits yielding 90 per cent of copper, to say nothing of a possible gold content, have been located in the province of Värmland, Sweden.

Thick Fuel-Oil Smoke Made Masks for the Rescuers a Necessity in This Office-Building Fire. The Force of the Explosion is Demonstrated by the Fire Box in Middle of the Room at the Right, Torn Out When a Tube inside It Burst

BOILER EXPLOSION TEARS OFF FIRE BOX

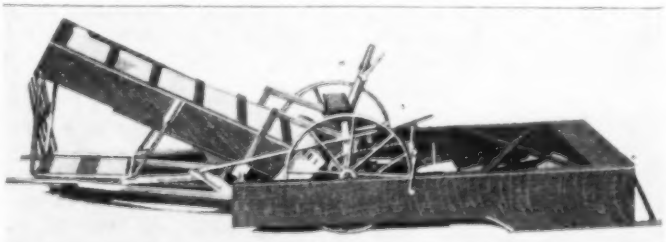
The engines kept right on running after a boiler explosion had killed three men and filled a 10-story building with steam and smoke. One feed pump, inaccessible to the firemen, continued to supply fuel oil to the flames from a broken pipe for 20 minutes. The cause of the accident may never be determined, as the men in the immediate vicinity were all killed; but it has been found that a boiler tube exploded inside the fire box, tearing it off as shown in the illustration. The fire that followed demonstrated the value of good masks to the fire fighters, as the thickness of the smoke made rescue work impossible without them.

GREAT PERSIAN OIL FIELDS ADD TO "WEALTH OF ASIA"

The famous oil wells of Baku have an oriental rival. Western Persia, between the mountains of Kurdistan and the Persian Gulf, is now known to contain oil fields whose content and value are beyond estimate. In the district of Irak-Ajemi, full of names suggesting rare and beautiful carpets, borings have yielded oil of exceptional quality, and disclosed a tract of nearly 400 square miles. A high percentage of benzine and kerosene is characteristic of the Persian oil. England has the concession to work the fields, and soon the looms of Kermanshah and Ispahan will give way to oil derricks.

JOB OF HARVESTING BEANS MADE EASY BY MACHINE

Harvest time brings peculiar worries to the bean grower, whose troubles a California inventor has undertaken to solve with a cutting machine that specializes on beans. The new harvester is drawn by horse or tractor and operated by one man. The rectangular frame at the front carries blades which cut two to four rows at once. The cut plants are then thrown by a toothed drum onto an inclined belt conveyor at the back. This in turn deposits them on a metal platform. Without stopping or leaving his seat, the operator can then dump the plants at any time.



Cutter Blades in the Rectangular Frame at the Front Cut from Two to Four Rows of Beans at One Time, the Plants Then being Conveyed Back to the Metal Platform at the Rear, from Which the Driver can Dump Them in Shocks

AMERICA'S PIONEER RAILROAD MASSACHUSETTS LANDMARK

Although America's railroad history is recorded as beginning when the Baltimore and Ohio laid its first rails in 1828, a pair of rusted strips of iron still visible in eastern Massachusetts tell of a pioneer transportation line whose inauguration antedated that event by two years. From the granite quarries of West Quincy the old road ran four miles to tidewater on the Neponset River, and carried granite for the building of the Bunker Hill monument. The rails, of hand-forged iron, 2 in. wide and ¾ in. thick, were held by hand-forged spikes to the granite roadbed. Mules were the locomotives, assisted by a cable where the grade was heavy.

Rails of Hand-Forged Steel, Laid in 1826, Still Cling to the Granite; and a Cable Ran over the Very Wheel That Lies in the Foreground

The Old Railroad Hauled Granite for Building the Bunker Hill Monument

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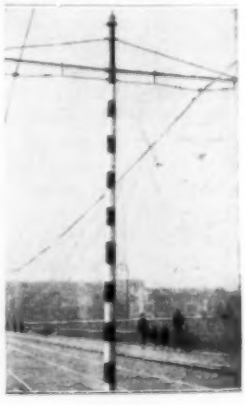
¶ Bottled milk, ice cream, and manufactured milk products appear to be favorite substitutes for their old line of business among the breweries, especially in Pennsylvania. Other brewers are turning their properties into mineral-water plants, warehouses, laundries, garages, machine shops, packing plants, and beet-sugar factories.

RED CROSS WILL FIGHT WORLD SUFFERING

The international committee of the Red Cross feels that world peace can never be more than a political catchword until the present prevalence of disease and suffering is abated. It believes, too, that by virtue of its international organization and past experience, the Red Cross is better fitted than any other agency to carry on such a regeneration. In consequence it is announced that a conference of all Red Cross societies will convene at Geneva, Switzerland, 30 days after the signing of the peace treaty, to consider a program which, in its general features, has already been commended by President Wilson and Premier Clemenceau. This program provides, in the main, for a central bureau at Geneva, which will receive medical reports from societies and experts in all corners of the world, these reports to be analyzed, coordinated, and published broadcast in every tongue. It is pointed out that the great pandemic of influenza could have been largely checked at its start by such an organization, with its experts everywhere at work on the problem.

STRIPES ON TROLLEY POLE WARN MOTORISTS

A southern city possesses some trolley poles that are painted in conspicuous alternate bands of black and white. The city current is usually sent underground; hence poles are a rarity and it is felt that local motorists might easily collide with the pole after nightfall; the more so as it is located in the center of a viaduct which is much used as a thoroughfare.



KEEPING PEACE *for the* SAKE of WAR

By E. T. BRONSDON

THE virility of the human race was proven anew during the World War by the friction engendered by contact under unusual conditions. The forces of civilization were one against the foe of mankind, but several upon certain semi-humorous occasions when disagreements arose among themselves. Usually altercations started over trivial matters, like a schoolboys' scrap, and ended by responsible parties separating the contestants, before too much damage was done. This was particularly true of such colonials as the Australians and Canadians, where the blood is that of pioneers rather than savants. The opinion may be ventured that if any other than a British subject were to impugn the record of the Australians at Gallipoli, the Canadians would be the first to spring to their defense. In view of the persistent rumors—savoring too much of German propaganda—we believe Mr. Bronsdon's exposition of the following incidents particularly opportune.—Editor.

IT is not known what designing genius inspired the strife-producing arrangement. Potsdam could not have done better.

The slant-eyed Ghurkas from Nepal—silent, fierce men combining the craft of Tibet with the pride and cruelty of Himalayan natives—were jammed next to a regiment of Sikhs from the Punjab. The Germans were counterattacking on this three-mile salient, while everywhere else the sweep of the Somme offensive drove them backward.

While the *stosstruppen* came on in persistent waves, the two colonial regiments fought side by side like so many thousands of friendly fiends. When the counterattack exhausted itself on the knives and bayonets of the Orientals, and the soldiers had a few hours of recuperation, in the words of a British signaler detailed to the sector, "'ell popped, immejit!"

The Ghurkas spied the blue-clad Sikhs—in dress, as in matters of food and religion, the latter troops insisted on maintaining their native custom—and knew them for the enemies they had feared and hated for centuries before the British occupation. Technically the dispute began over the possession of a goat, brought up to be slaughtered for a certain squad of Sikhs. Whatever the real cause, in ten minutes the whole sector was a scramble of personal combats to the death, and a whole Devonshire division was called upon to separate the supposed allies. When at last the Indians were pried from each other's throats, over a hundred casualties had occurred. The Sikhs were removed from the vicinity immediately, and later taken to Mesopotamia, where they gave gallant service against a foe with whom they could grapple to their hearts' content.

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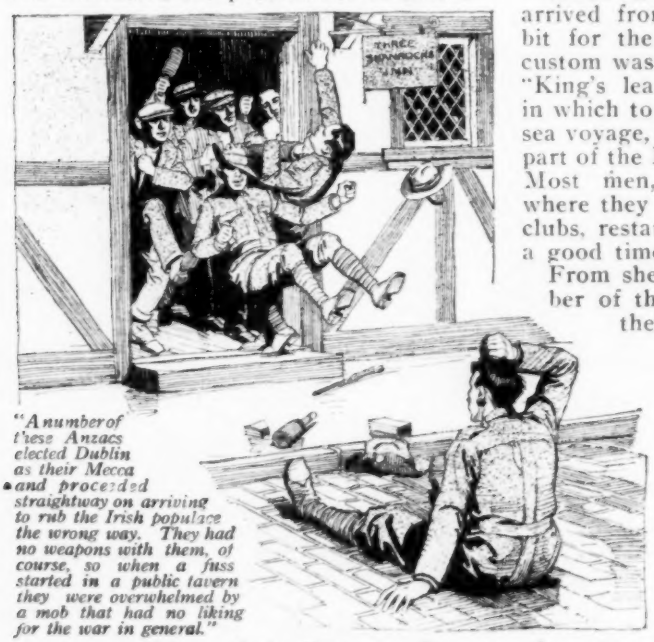
Had the Huns known the details of this internecine battle, they might well have penetrated the sector to a damaging extent. Providentially, they thought they had exhausted the possibilities in that direction, and kept their distance. It was suggested later in a trench paper that the "Huns were too bally sensible to risk their hides in that kind of a rumpus."



"A number of these Anzacs elected Dublin as their Mecca and proceeded straightway on arriving to rub the Irish populace the wrong way. They had no weapons with them, of course, so when a fuss started in a public tavern they were overwhelmed by a mob that had no liking for the war in general."

While this incident was one of the most striking of some regrettable happenings that occurred among the British colonials during the course of the war, there were others for which even less excuse can be found. T. P. O'Connor, the Irish orator, struck at the heart of the matter in a speech before the Hibernian Club last year. "It is deplorable in a way, and glorious in a way—but true anyway—that every contingent of His Majesty's troops believe themselves by far the finest men, the best fighters and the most indispensable soldiers on the face of the earth," he said. "The Scots will tell you to a man that the Hielan' r-r-regiments cannot be sur-r-rpassed, sor! The Canadians will wager anything on their Princess Pats, while the Irish . . . . ." And "Tay Pay" betrayed the fact that he considered the boys from the Emerald Isle to be the decisive factor in every war, no matter where it was fought, or by whom.

Considering the matter in the cold light of retrospect, undimmed by the need of prudence or the smoked glass of censorship, it perhaps was fortunate for Britain that her various nephews "hated the Hun worse than they loved each other."

When the first 30,000 Anzac troops arrived from the antipodes to do their bit for the empire and civilization, the custom was to give every colonial instant "King's leave." This meant eight days in which to stretch his legs after the long sea voyage, and free transportation to any part of the British Isles he desired to visit. Most men, of course, chose London, where they were given the run of all the clubs, restaurants, and theaters, and had a good time generally.

From sheer perversity, though, a number of these Anzacs elected Dublin as their Mecca, and proceeded straightway on arriving to rub the Irish populace the wrong way. They had no weapons with them, of course, so when a fuss started in a public tavern they were overwhelmed by a mob that had no liking for the war in general, and who had decided to hate Anzacs in particular. Battered, with some of them unconscious from wounds, the amazed visitors were given the last indignity. They were thrown into a civil prison!

Of course, this could not last. Under heavy guard they were led out and shipped back to England. Immediately, on hearing the details of the story, every last man in the Anzac expeditionary force put in an application for leave—the tacit reason being "overseas service in Ireland!" The authorities were too wise to permit this, naturally, and from that time on no Australian or New Zealand fighters were allowed to go to Ireland. Even at the time of the Sinn Fein rebellion an Anzac detachment quartered at Bramshott Camp was slighted deliberately, though its commander, Brigadier General Carey, expressed his willingness to help out in the emergency. Had they gone over, it is likely that Sinn Fein and Ireland would have become synonymous in a day.

Shortly before the second battle of Ypres, three battalions of Scotch kilties and a brigade of Welsh fusileers were in billets at Steenvoorde and in the immediate vicinity. As always happened, when troop units of these nationalities got together, there was a football game. Every

soldier who could possibly squirm out of fatigue duty attended. The game finished with the Welshmen victors, three goals to two.

The Scotch took their disappointment with fair grace, taking into account that huge sums of money—considering the rate of a soldier's pay—changed hands. A chance for revenge was seen, however, by a coterie of the Highlanders. Each platoon possessed at least one game cock, and the Welsh were inveigled into matching their birds the following evening. The back room of an *estaminet* was transformed into a pit, and the feathered warriors met. As was imagined, a great majority of the Scotch fowl proved the hardier, and the lost pay was regained. In the arguments that arose following the cockfights, however, a number of the soldiers lost their tempers. One of the bloodiest free-for-all fist fights ever waged ensued, in which every member of both contingents present engaged. Noses were bashed, jaws knocked askew, and not a few of the combatants were badly injured, before a detail of military police broke up the affair. It was mainly on account of the bad blood thus engendered that neither Scotch nor Welsh were given an opportunity in the great battle which came a few days later. Both had been sent to points in the line widely separated.

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This incident, while not of the kind which makes for harmony in the forces of a nation fighting for its life, possessed the redeeming feature of not causing any fatalities. The soldiers used no weapons other than those nature provides, while in many of the other brushes, particularly between colonials, knives, revolvers, bayonets, and even machine guns played a part.

One of the worst of these occurred early in the war, between the Canadians and Anzacs. Intense rivalry always had existed, and this manifested itself in strange ways at times, and in none more bitterly than the following.

The second Australian division had participated in the fiasco at Gallipoli. It had hurt their pride terribly not to accomplish their objective, so when the time came that they were withdrawn and placed on the western front, each man was as sore in spirit as an ulcerated tooth is in the flesh.

Imagine the feelings of the portion that first went to the front-line trenches beside the Canadians to find awaiting them the rude figure of a horseman, mounted on a whitewashed wooden steed with its forelegs upraised.

A hand with pointing finger perched above the horse's tail bore the terse legend "Gallipoli." Another hand, with finger indicating the course the horseman evidently was pursuing at breakneck speed, was labeled "Gallop-away!"

An altercation, with much bitter repartee, arose, but a fire was lit that smoldered for days, finally to break out in a terrible small-scale trench battle in which machine guns were turned upon each of the parties of combatants by the other. Had the authorities not interfered immediately, a fair-sized war between Canada and Australia would have been fought out right then and there, without any sort of a declaration by either country.

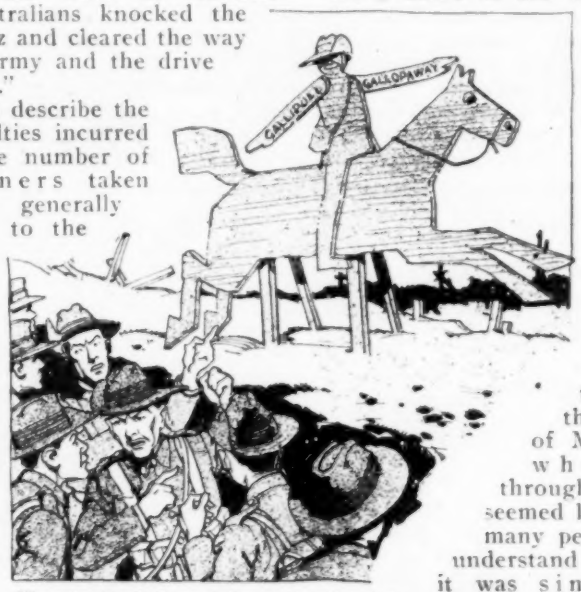
A "sandwich filling" of French troops was summoned immediately and placed between the two branches of colonials, who ever after were kept apart as far as possible. Though reason and common sense came to rule fairly well before the armistice was signed, there never was a time when Anzacs and Canadians were not ready to jump each other.

The next to last manifestation of this spirit came when during the festivities in London following the signing of the armistice Maj. Gen. Charles Rosenthal, commander of the Anzac forces, made a speech to an assembly of his men. He reviewed their achievements, dwelling particularly on the work at Amiens, where "the Australians knocked the spirit out of Fritz and cleared the way for the British army and the drive of August eighth."

He went on to describe the number of casualties incurred (211,349) and the number of German prisoners taken (142,608), and generally gave full praise to the men under him. This would have been all right had not some one conceived the notion of printing this speech and pasting it up on the Canadian barracks at Morraught, and elsewhere. Overnight an amendment appeared, in the form of a printed slip pasted below. In lurid language, this slip told how the Anzacs were assuming credit belonging elsewhere, and stated baldly that the Anzacs had waited until Fritz was "jolly well licked before getting into it much, if any."

As a result all the slips with the amendments were torn down, and the colonial troops were sent to separate embarkation points.

As a finale to the whole trouble, the plan of shipping Anzac soldiers home through Canada was broached. This did not get far, as the Canadian government refused instantly to allow any such thing. The Anzacs could go through the Panama Canal, through Suez, through the Straits of Magellan, or anywhere, but not through Canada. This seemed like discourtesy to many people who did not understand the situation, but it was simple precaution. Nothing worse than continuous discomfort for the travelers probably would have occurred, but in the light of events that had transpired, it was considered best to take no unnecessary chances.



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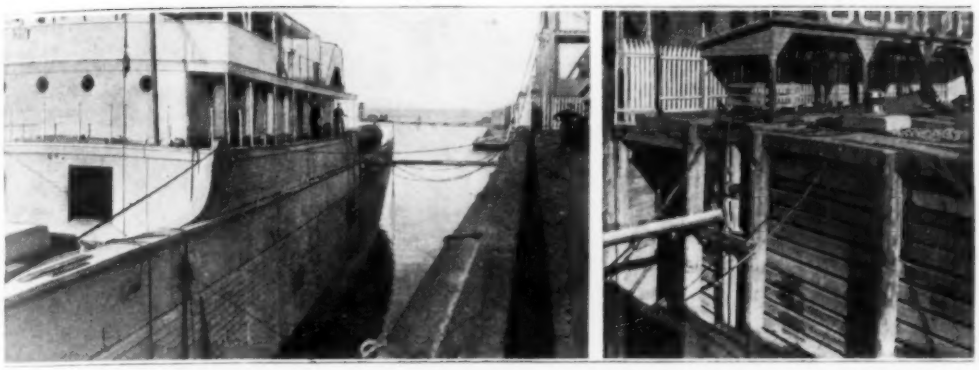
This is Not a Grocery Store Display but the Exhibit of a Patriotic Bank to Boost Food Production and Conservation. Its Location in Paterson, New Jersey, Which Has a Large Italian Population, Explains the Foreign Inscription Below. This Means "Savings Bank. Interest Paid on Deposits"

BANK WINDOW FRAMES GARDEN EXHIBIT

Pumpkins and preserves are vying with mortgages and bonds in the interest of this thriving bank which realizes the importance of abundant food production and conservation. In patriotic response to the national war-garden campaign, the show window is now utilized for a permanent display of prize products of backyard garden and kitchen. Despite its foreign name the bank pictured is a prosperous, all-American institution, located in an eastern city.

¶ Thick beds of graphite in northern Siberia are reputed to be nearly equal in quality to those of Ceylon and less expensive in operation.



The Ship in the Left View is being Pushed Away from the Dock by a Breasting Pole Moved Out from Under the Dock by a Capstan. The Right Picture Shows the Pole Emerging, with the Cable That Pulls It Running over Rollers and Back to the Capstan on the Dock. The Side Ropes Prevent Swerving as the Pole Comes Out

SLIDING POLE SET IN DOCK SAVES SHIPS FROM FIRE

To the growing list of devices for saving property from possible destruction has been added an ingenious and extremely simple arrangement for moving ships away from a burning dock. A stout pole, 40 ft. long, is set on rollers under the dock and, of course, at right angles to it. A cable from a capstan on the dock runs over pulleys on the edge, back into the hole in the dock and is attached to the butt end of the pole. When the capstan is operated, either by hand or steam, the cable pulls the pole out of its hole against the side of a ship lying at the dock. Guiding cables fastened to the outer end of the pole prevent side sway. Two poles, at stem and stern, are sufficient for ships of ordinary size, and will move a ship safely away from the dock in 20 seconds.

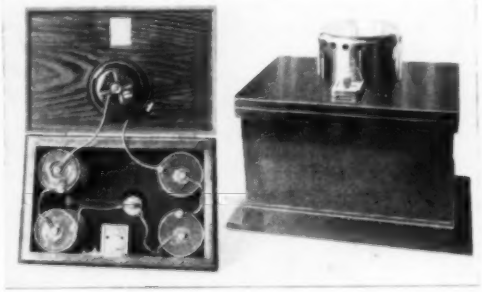
AWNING SCREENS MOVEMENTS OF DERRICK

A contractor on a large structural job recently observed that his carpenters at their benches invariably took "time out" to watch the swaying loads carried over their heads by a large derrick. He recognized an irresistible human impulse here, but decided he could defeat it. He ordered a flimsy canvas awning constructed over the workmen on the ground, and now reports a 10-per-cent saving in working time.

¶The Labor Department has announced its intention of extending the U. S. Employment Service to our insular possessions.

ELECTRIC ANTITHEFT DEVICE FOR MOTOR VEHICLES

To check automobile thieving is the purpose of an electric accessory lately devised for the motor car and demonstrated before police authorities of an Ohio city. Essentially the contrivance consists of an automobile siren connected in a dry-battery circuit with a mercury switch. The latter comprises a vibrating arm, of about knitting-needle thickness, on which is mounted a covered metallic cup that holds mercury. Passing through the lid of the cup is an insulated contact member which, when in normal position, is within a sixteenth of an inch of the quicksilver. When the car is in motion, vibrations agitate the mercury so that the gap is



Showing the Inside Arrangement and the Outside Appearance of the New Electric "Burglar Alarm" for Motor Cars

bridged and contact formed, sounding the horn in the event the circuit is closed. Thus if anyone, without the owner's knowledge, attempted to steal a car so equipped, the siren would sound immediately and keep on doing so until the engine was stopped or the electric circuit opened.

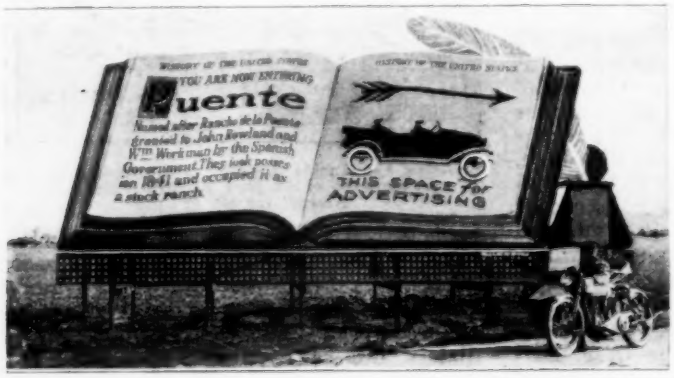
CONCRETE TELEGRAPH POLES MADE IN UPRIGHT MOLD

Vertical molds are used at a plant in West Haven, Conn., for casting concrete telegraph poles. Four of the molds are supported by a towerlike frame of timber. Chains, hung from the top of the tower, are used for reinforcing the upper half of the poles, the lower half being strengthened by a hollow steel core held upright in the center of the mold. The mixture is hoisted to the top of the tower and poured into the molds, which are removed early enough to dress the poles to a smooth surface before they set.

Four Molds for Concrete Telegraph Poles are Supported Vertically by This Timber Tower. The Poles, Reinforced by Steel Cores and Chains, Hung from the Top, are Cast by Hoisting the Mixture up the Tower

EDUCATIVE BILLBOARDS INTEREST MOTORISTS

The automobile tourist is soon to find travel a more enjoyable and profitable experience as a result of an advertising device inaugurated by a large manufacturing company. Billboards displaying bits of local historical interest will be placed on the outskirts of many communities, awakening an educative interest in community life and tradition which should be profitable to both tourists and residents.



These Bits of History Are Sure to Awaken Us to the Interest and Appeal of Our Own Land

ARMY HAS LARGEST ENGLISH UNIVERSITY

The new American Army University which offers a three months' course at Beaune, 175 miles southeast of Paris, is perhaps the most outstanding element in the extensive educational work carried on by the American Expeditionary Forces in France. Housed in what was formerly an American hospital are 15,000 soldier-students and a force of 500 teachers. The curriculum is notable for its agricultural college with a 600-acre farm, its engineering department, which uses the old hospital workshops, and the studies in art and architecture, which are interesting almost 1,000 men.

"PERSHING ROAD" TO CONNECT TOWNS KNOWN TO WARRIOR

A project to immortalize the communities intimately identified with the personal history of Gen. John J. Pershing has been launched with the temporary organization of a "Pershing Highway" association at Lincoln, Neb. A road, 3,000 miles long, running from New York City to San Francisco, is the proposal. Its course would be through Philadelphia; Trenton, N. J.; Baltimore; Washington, D. C.; Columbus, Ohio; Indianapolis; Springfield, Ill.; Laclede, Mo., Pershing's birthplace; St. Joseph, Mo.; Lincoln, Neb.; Cheyenne, Wyo.; Salt Lake City; Carson City, Nev., and Sacramento. Governors of the states through which the proposed highway would pass have already been invited to help form a permanent organization for the development of the plan.

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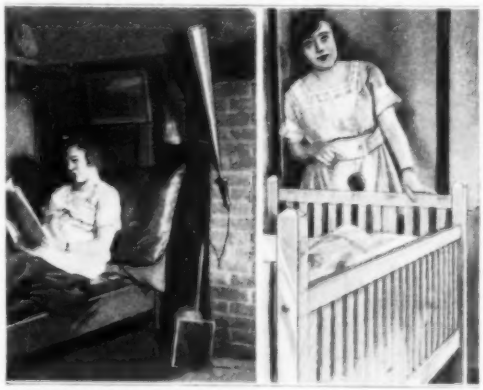
Heavy Rains Caused the Collapse of This Dike, near Amsterdam, Holland. It will be Noted That the Right-Hand Track of the Railroad, as Well as the Passenger Train on It, was Swept to the Bottom of the Embankment. Workers are Seen Searching for Killed and Wounded Passengers

WHEN HOLLAND DIKE CRUMBLES WHOLE TRAIN IS WRECKED

For most people the dikes of Holland have held a romantic suggestion of peril ever since mother read them the story of the boy who stopped the leak with his arm. A short time ago a dike near Amsterdam was undermined, not by the seepage of the sea, but by heavy rains. The disintegration of the earthen embankment destroyed a railroad line along the top and completely wrecked a loaded passenger train, killing at least 50 and injuring 100 travelers. The cars were rolled to the bottom of the bank in a tangled mass.

DICTAPHONE CALLS MOTHER WHEN BABY CRIES

A dictaphone with a megaphone, and a loud-speaking amplifier in the receiver, is the gift of an ingenious husband to his wife. With the receiver fastened to the baby's crib in the nursery upstairs, and the megaphone placed in the parlor below, the arrangement works to everyone's satisfaction. Mother may go about her housework, while baby will sleep soundly, undisturbed by the noise of the living rooms. Should he waken, however, his demands will be heard instantly through the house.

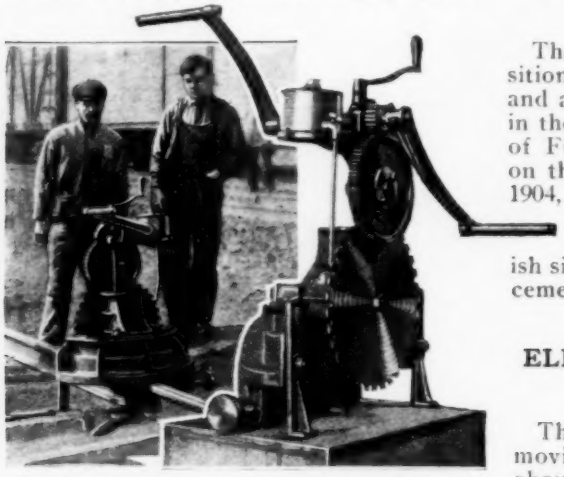


COPYRIGHT, JOHN EDWIN HOGG
The Dictaphone will Warn This Mother When Her Baby Cries. The Receiver is Placed at the Head of the Crib

¶An Atlantic seaport for Switzerland, Bohemia, and other inland nationalities, is the aim of a new movement in France, intended to free them from economic bondage to Germany.

PORTABLE RAIL-CUTTER GEARS DRIVE SAW BY ITS TEETH

An odd feature of a portable hand-driven saw for cutting railroad rails, developed at St. Louis, Mo., is that its circular saw is driven by a steel sprocket engaging the



Portable Hand-Driven Cutter for Railroad Rails: Its Saw is Driven by Gears Meshing with the Teeth. Seen at the Left, Clamped to the Rail Ready for Work

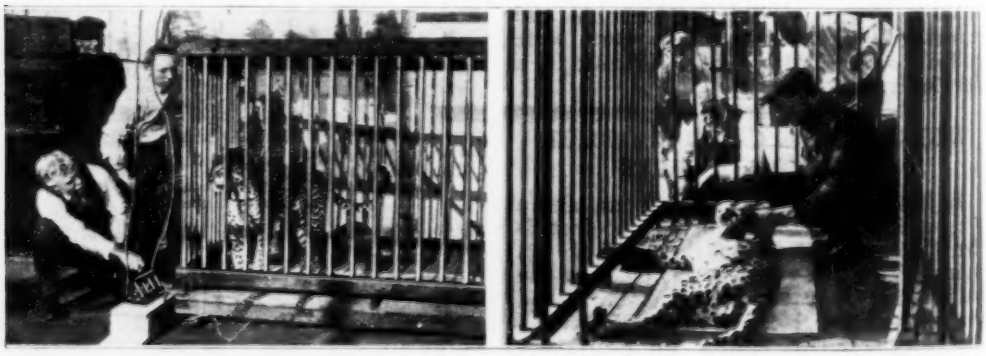
periphery of the blade. Positive feed and a very small saw arbor, giving greater clearance, are the advantages of this arrangement. The sprocket is adjustable for wear. The saw is 18 in. in diameter and 3/16 in. thick, and makes a smooth vertical cut to a depth of 7¾ in. at any desired angle to the rail. Cranks, reducing gears, and saw are mounted on a slide, which feeds automatically at the proper speed for cutting standard rails; but hand-feed may be substituted by releasing a nut on the feed screw. The machine weighs 350 lb., and is moved along the rail, when not clamped to it, by throwing into position a roller at the rear. An electrically driven model with saw-grinding attachment, weighing 450 lb., has also been developed along similar lines.

TUNNEL THROUGH PYRENEES RECENTLY PIERCED

The rigors of mountain weather, opposition from the national ministries of war, and a difference in gauge have all united in the past to prevent an effective joining of French and Spanish railways. Work on the project has been carried on since 1904, however, and it is now announced that a new tunnel from Ax, in France, to Puigcerda, on the Spanish side, has been broken through, and will cement this desirable union more firmly.

ELECTROCUTE HUGE LEOPARD TO SAVE PELT

The only requirement imposed on a movie leopard is that he look pleasant about his work. But one of these beautiful beasts recently took to sulking—a failing which made him decidedly unpopular with actors in jungle scenes. The manager of the company at last decided that he must die, rather than continue as a menace to those acting with him. Shooting "David" with a high-powered rifle was first considered, but was objected to, as it would disfigure the valuable pelt. To avoid this, electrocution was decided upon, using power from a near-by station. A steel plate was secured to the floor of the cage and connected with the 6,000-volt line. The leopard was placed on the plate, and the other wire fastened to his leg. A turn of the switch, and "David" passed to his reward.



PHOTOS BY KEYSTONE VIEW CO. PICTORIAL SERVICE

Views Show Refractory Movie Leopard before and after Taking 6,000 Volts of Electricity. Shooting the Animal would have Disfigured His Pelt

WHERE MATERIAL SCIENCE GIVES AID TO SPIRITUAL PROGRESS

Signs Like This Are Now a Familiar Application of Electric Lighting, Adding Secular Conspicuousness to Ecclesiastical Dignity

Oldest, Most Popular, and Perhaps Most Impressive of All Illuminated Church Signs is the Blazing Cross, Symbol of Hope Shining in the Dark

Modest Signs of Few Lights Cast Their Rays Not So Far but Just as Earnestly. This One is to Be Found in New York City's Italian Quarter

EVER since priestcraft passed into disfavor, leaving unsolved mysteries of applied mechanics, the church has considered its few uses of the technical arts with extreme circumspection. The necessary conservatism of the cloth has made it especially sensitive to the orthodox dread of theatrical effect, under which classification flashing signs and tricks of mechanism seemed so readily to fit. It is only with the growing realization of the dignity of publicity, the virtue of illumination, and the nobility of those natural laws on which depend all science and all mechanics, that divine service finally has accepted the coöperation of technology.

The world beats no path to any door that is inconspicuous. The house of worship, serenely aloof from the banalities of commerce, but forced by the frailties of wavering human eyes and minds to compete with other appeals, finds help in the blaze of electric lights and the magic of ingenious signs. In the city of New York more than 150 churches send the calm influence of their beacon rays into the dark and doubtful corners and byways. Many an untold tale of redemption is said to hang upon the blazing cross of St. Anthony's spire—the pioneer of illuminated sacred finger posts, dating back to gas-jet days in the 70's. Those chapels too modest (a common fault) to aspire to the 400-candlepower cross find humble assistance in little four-lamp reflectors that throw their feeble but earnest rays on a simple lettered sign.

But electrical display is not the end of the modern alliance between religion and science, nor does the latter's coöperation stop outside the sacred edifice. More than one zealous pastor has applied the tremendous magnetism of the motion picture to the problem of keeping the flock contented in the fold. On one occasion a crew of camera men, under the temporal guidance of an enterprising minister, took views on windy Fifth Avenue corners to illustrate a sermon on the immodesty of the prevailing fashions. For once, at least, there was no question about attendance!

Especially engaging just now, is the inspiration of a Los Angeles pastor, from the steps of whose prosperous church on a recent Sunday morning a bugler—one of the congregation's service stars returned from overseas—blew the "Call to Colors." Many of the young army men who gathered to the notes accepted the clergyman's invitation to enter; and he forthwith determined that the bugle call to worship should continue as a Sabbath feature.

Parishioners of a Kansas City church who had acquired a tardy habit, not unusual on the day of rest, were brought effectually to time by a reversible sign, ingeniously turned around by clockwork at the moment services began. Early arrivals were greeted by the comforting legend, "I Am Prompt! How Glad I Am!" while the tardy ones were reproached with, "I Am Late! I Am Sorry. Next Time I will See the Other Side of This Sign."

A church in an Arkansas town takes up its collection with one of those cash carriers used in department stores. From the pulpit the minister shoots it down the

track above the aisle, and on the way it is stopped at every pew by means of a series of lugs on the track. When the end-seat occupant feels that his particular pew has done its contributory duty, he pushes the collector along.

Entirely different in conception and more curious, perhaps, was the enterprise of a Kansas clergyman, formerly a telegraph operator, who arranged during the war for a wire connection from the railway station to his pulpit. When the clicking sounder told him a troop train was coming, he promptly dismissed services, and everybody went down to see the boys go through. The trains never stopped, so he obtained some hoops like those used for delivering train orders on the run, and with them the congregation passed candy and cigarettes through the car windows to the soldiers.

Returning to our first interest, the electric sign, most peculiar of all is the one on a church in a Kansas community, which attends particularly to the spiritual needs of railroad men. In semblance of a fiery block semaphore, this impressive signal sets the "stop" against those who would thoughtlessly hurry on down the road to perdition, and its red lantern, warning of danger, bids them enter the gospel station and get the right of way before they start on the next division of life's schedule.

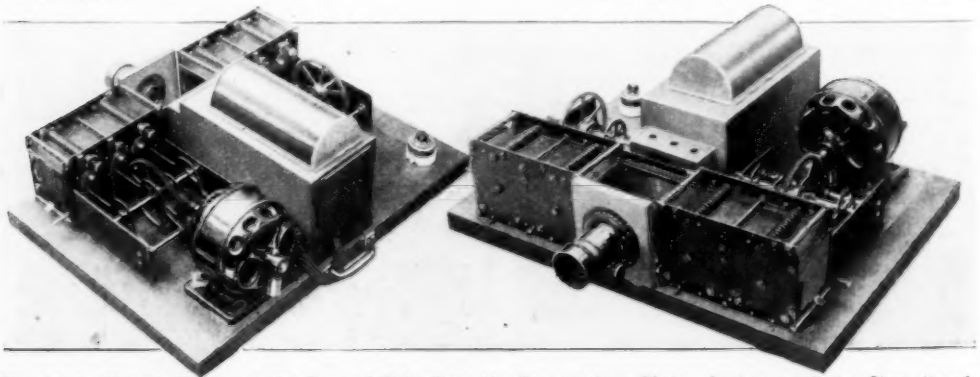
SCULPTOR EMPLOYS CAMERA TO VERIFY WORK

A sculptor with originality uses the camera to verify the exactness of his work. It is believed that defects and resemblances can be checked in this way much more carefully than by reference to the subject.

By Consulting This Picture Sculptor can Make Easy Comparisons between Original and Copy

AUTOMATIC SLIDE PROJECTOR CHANGES ITS OWN VIEWS

Pictures projected on a screen have a value for advertising, educational, and entertainment purposes limited only by the fact that an attendant must constantly be present to operate the projector. To obviate this objection, a stereopticon has been devised whose operation is wholly automatic. The standard-size machine has a capacity of 46 slides, and projects them one after another. The picture is changed every 12 seconds, and the machine starts over again when it reaches the end of its series. A small electric motor operates the mechanism, and a 1,000-cp. incandescent lamp furnishes ample illumination for a large, clear picture. The dimensions of the complete machine, 26 by 19 by 7 in., permit carrying

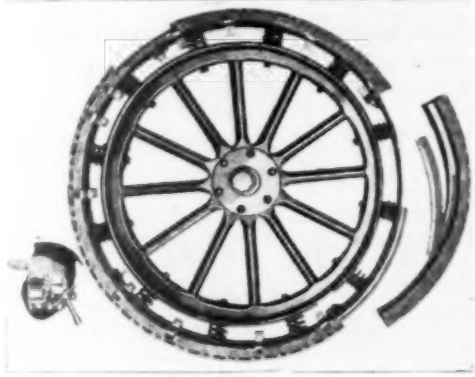


The Little Electric Motor at the Rear of This Portable Stereopticon Makes It Automatic by Changing the Slides Every 12 Seconds. It Holds a Series of 46 Slides in the Magazine at the Front

it in a case of suitcase size. Special models for lecture work are made holding up to 200 slides, with a push button for controlling the screen time of the pictures.

PUNCTURELESS AUTO TIRE APPLIED IN SECTIONS

That punctures continue to be the bane of the autoist's existence is demonstrated by frequent ingenious efforts to make them impossible. Now a Denver inventor is displaying a wheel with a false rim in four quadrantal sections, with three spiral springs between each section and the felly. To this rim are fastened similar sections of semicircular rubber tire tread, with shorter rubber sections as a filler, taking the place of the usual inner tube. The clamps that hold the tire on are quickly removed or



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Sections of This Punctureless Auto Tire may be Removed in a Few Moments with a Socket Wrench. Spiral Springs Make the Wheel Resilient

replaced with a socket wrench. The ordinary tool box will hold spare sections.

CAR FERRY MAY CROSS ADRIATIC SEA

War-time experience with car-ferrying across the English Channel has demonstrated the practicality of a proposed railway line from Rome direct to Constantinople. Instead of the present northern route through Udine, the projected line will run its trains south from Rome to Brindisi or Otranto; thence by ferry across the Adriatic, about 45 miles wide at this point, resuming the land journey at Avlona, Albania. Such a development would hasten the reëstablishment of stricken Serbia, and shorten the distance from Rome to Constantinople 640 miles.

CHAIN LINKS OPERATOR TO BED OF POWER SAW

Increased efficiency is claimed by the designer of an original wood-sawing ac-

COPYRIGHT, JOHN EDWIN HOGG

The Body Harness and Link Fastening Enable Worker to Return Sliding Bed by Stepping Backward

cessory. To the sliding bed which carries the logs against the revolving blade he attaches a chain which hooks to a strap about his body. Consequently, when the log has been cut, the sliding bed is returned to its starting position by the natural act of stepping backward, leaving both hands free to handle the log. This is considered less clumsy and much safer than the usual method, which requires one hand for the bed and one for the log.

SEA GULLS FATTEN IN WAKE OF TRACTOR PLOWS

A recent strike among sea fishermen along the Pacific coast has developed a remarkable and unexpected result. Flocks of sea gulls, accustomed to easy pickings on refuse from fishing vessels, have been driven inland, where they now patiently follow tractor plows which bring appetizing grubworms to the surface. Spectators will testify that the gulls are growing fat on their new diet.

Sea Gulls Fattening in Wake of Tractor Plow by Snatching Up Exposed Grubworms

IMITATION CONCRETE SHIP CANADIAN PARADE FLOAT

An ingenious Canadian parade float is reported from Sydney, Nova Scotia. It was built to represent a reinforced-concrete motor ship which is actually under construction at that port—the first of its kind in Canada. The float was made of spruce slats covered with wallboard and mounted on a motor truck, and, with flags and pennants flying in the breeze, made a striking appearance in the Victory Loan parade. It was decorated with electric lights for night driving. Two men from the shipyard assembled the float in three hours.

Float Imitating a Concrete Ship, Used in a Canadian Victory Loan Parade: It was Made of Wallboard on a Spruce Frame, Mounted on a Motor Truck, and Fitted with Electric Lights for Night Work

¶A canal from Antwerp on the North Sea, to Marseilles, on the Mediterranean, is a new European reconstruction project. The proposed route goes clear around by way of the Rhine, across to the Saône and thence down the Rhone, and would float 6,000-ton ships.

AIR FIGHT IS STAGED FOR MOVIES

A fast German two-seater and an American "Spad" were recently seen in violent combat above an American aerodrome in France. Watchers below saw a figure fall from the Hun machine, strike the ground, and burst, scattering straw in all directions. The body was soon followed by both fighting planes — which landed very nicely, however. The pilots, both Americans, were congratulated on the realism of their mock combat. Every maneuver in the "engagement," culminating in the fall of the dummy, had been filmed by an observer in a third machine which had hovered as near the combatants as safety permitted.

WOMAN DOCTOR OF GARDENS TREATS FLORAL AILMENTS

City folk who have undertaken a back-to-the-land movement with more zeal than knowledge, and presently find their gardens going into a mysterious decline, may now secure the services of a regular garden doctor. That is the profession adopted by a woman graduate of a horticultural school near Philadelphia. One of her methods is to give the land owner a course of lessons in beautifying his property. These instructions do not overlook the problem of making gardens profitable as well as delightful.

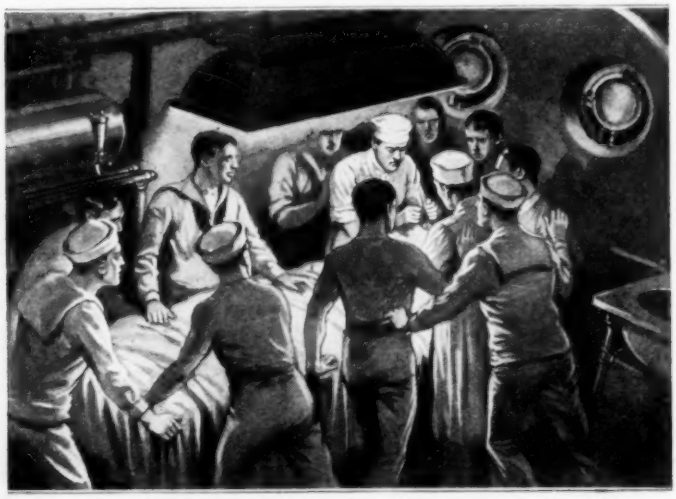
AIRMEN STOP RUNAWAY BALLOON WITH SANDBAGS

After a thrilling and spectacular chase of more than 60 miles, an army observation balloon, which broke away from its moorings in a squall, was brought down near Riverside, Calif., recently by the weight of sandbags hurled upon it from above by three airmen. An unexpected windstorm ripped the fins off the great bag, and the balloon then became entangled with five others that were aloft on the field at the time, and in the efforts of the ground personnel to haul all the "sausages" down, the bag snapped its cable and sailed away. Three fliers in as many planes immediately went aloft and gave chase. A hot pursuit followed before sandbags dropped by the airmen ripped the bag, weighted it down, and decreased its buoyancy, until it was driven to earth. In grounding, the balloon uprooted a number of fruit trees and damaged electric and telephone wires before being anchored down by a corps of motorcycle soldiers who had given chase on the ground. Unfortunately the accident cost the life of a cadet, who fell from the balloon from a height of 3,000 ft., when the storm struck it.

Three Army Planes are Shown Dropping the Sandbags Which Brought Down a Runaway Observation Balloon. Soldiers Following on Motorcycles Were Able to Catch and Anchor the Bag Only after a 60-Mile Cross-Country Chase, Featured at the End by Much Damage to Fruit Trees and Telephone Wires

"ANCHORED" SURGEONS OPERATE IN STORM AT SEA

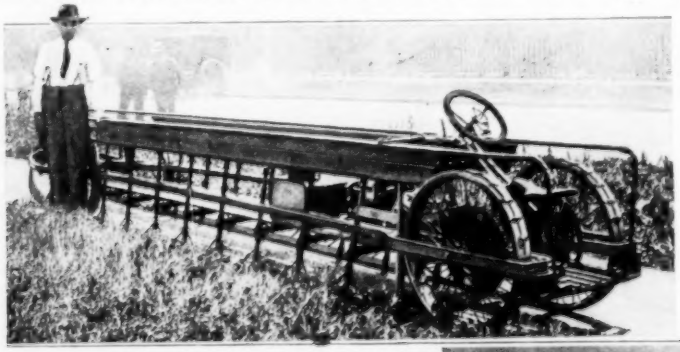
In a storm of extreme violence, with the decks tilting to an angle of 38°, two surgeons on a homeward-bound troop ship performed an oft-interrupted operation of great delicacy and saved the life of an American soldier. A wave, declared to be 50 ft. high, had smashed the porthole glass through which he was gazing, fracturing his skull and injuring one eye. The patient was held upon the operating table by the ship's chaplain and three sailors, while six more sailors by main force "anchored" the surgeons against the table. Working mainly in the pauses between the terrific plunges of the ship, they successfully trepanned the soldier's skull and dressed his injured eye. The whole operation took two hours.



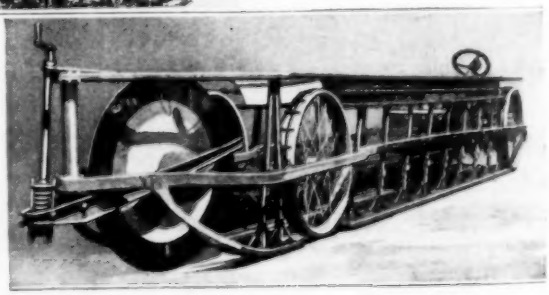
It Required Four Men to Hold the Patient on the Operating Table, and Six More to Keep the Surgeons from being Hurled Away by the Violent Plunges of the Ship

GASOLINE "DOG SLED" FOR ALASKA MAIL ROUTE

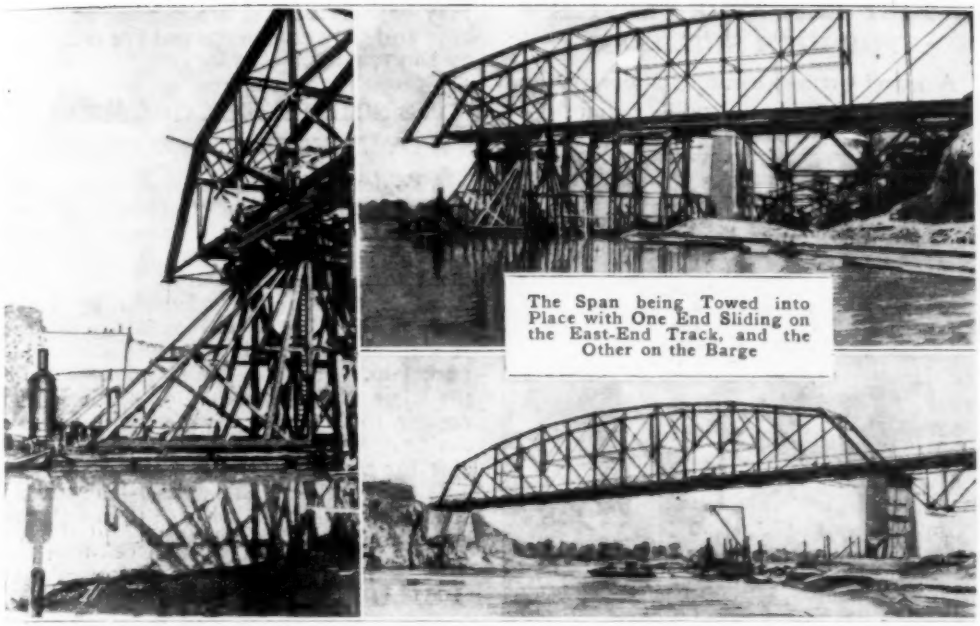
Those half-wolf huskies that haul Alaska's mail over hundreds of miles of snow and ice will have to look to their time tables and mind the whip, or the gas sled will get their jobs. One has already been designed with that intention, and is being tried out. Its runners are light endless-belt treads like those of a tractor, and it breaks its own trail. In front is a sharp-edged rotary rudder, which may be adjusted as conditions require, to cut deeply or lightly into the frozen surface, and the steering is done from the driver's seat, at the extreme rear, with a regular automobile wheel. The gasoline engine is just in front of the driver, and might help to keep him from freezing. The huskyless dog sledge is 25 ft. long, weighs 800 lb. and has carried 1,500 lb. 100 miles a day. The dogs are averaging 25 miles a day with 650-lb. loads over trails which must be broken for them in advance.



Power Plant, Driver's Seat, and Steering Wheel Are at the Rear of the Gasoline "Dog Sled," Whose Endless Tread Breaks Its Own Trail



Viewed from the Front, the Sharp-Edged Rudder Wheel Is Visible, as Well as the Screw Adjustment for Raising and Lowering It to Cut Deeply or Lightly into the Frozen Surface According to the Condition of the Trail



The Span being Towed into Place with One End Sliding on the East-End Track, and the Other on the Barge

Left: The West End of the Span, Supported by Scaffold of Piling on Floating Barge. Right: The Span in Place, having been Hauled into Position by Cables in Three Hours and 40 Minutes

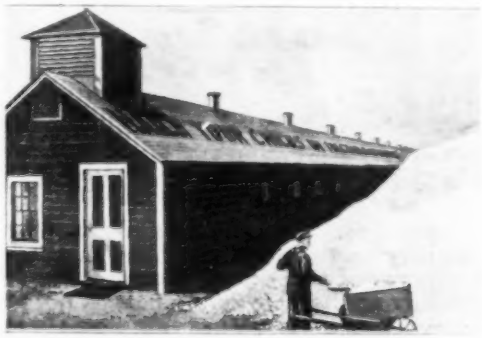
BIG BRIDGE SPAN FERRIED ACROSS SWIFT RIVER

Twice the swirling current of the Colorado River defeated the engineers who were trying to install a big steel highway bridge at Yuma, Ariz. It sucked out of the river bed, first, 75-ft. and then 90-ft. piling intended for the temporary support of the long center span of the bridge. Then the exasperated chief engineer secured a big wooden barge, and built upon it a scaffold of piling as it lay at anchor under the end of the span, to which the floating structure was then made fast. Most of the huge steel fabric now lay well back on the east-shore span, while on the west shore the concrete abutment was made ready. Then slowly, almost inch by inch, stout cables towed the barge across the river, its burden increasing as the long span slid gradually along its shore support. It was 2:40 p. m. then; at 6:20 the west end of the span slipped accurately into the abutment sockets, and the watching population of Yuma drew a long breath.

¶ To overcome the effect of moisture on optical instruments it is suggested that lenses be boiled in distilled water before being put in place, and that the instruments be made air-tight, if possible, and filled with dry air.

EGGSHELLS HAULED BY WAGONLOAD

America possesses some of the largest chicken hatcheries in the world, a single establishment sometimes having a capacity of 225,000 eggs. One room in such a hatchery has 33,000 eggs in process of incubation at one time. An interesting by-product of the industry are the shells which accumulate in mountainous piles. They are not wasted, however, but are

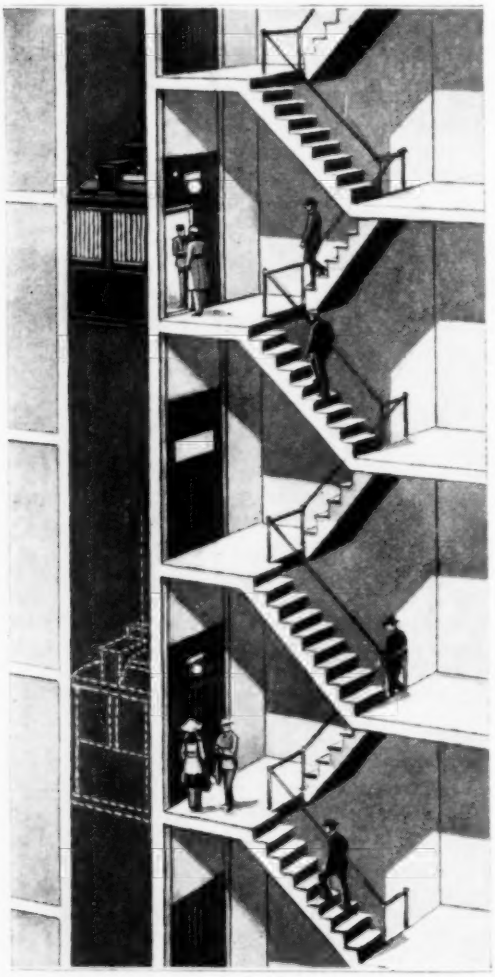


This Man is Shoveling the Eggshells Which Form a Valuable By-Product of Mammoth Chicken Hatcheries

ground and sold to chicken raisers for feed, principally as a bone builder, thus completing the cycle to everyone's satisfaction.

FAST ELEVATOR SERVICE FOR HIGH BUILDINGS

A novel arrangement of stairways and elevators for high office buildings has two possible advantages. Realizing that the



In This Elevator System Each Car Serves Two Floors, Promoting Rapid Operation and Thus Increased Passenger Capacity. The Stairway and Elevator Shaft Form a Fireproof Unit

greatest loss of carrying time is caused by stopping and starting cars, the inventor has provided that passengers enter elevator only at alternate stair landings, not at floors themselves. Thus all floors are served equally, and elevator speed is so increased that many more passengers may be carried per day, a particularly desirable feature for very tall structures where congestion is usually the rule during rush hours. And by combining stairways and elevators in this fashion, the entire shaft may be isolated and fireproofed, so that a safe and easy exit in case of fire is insured to the tenants.

ODD SOLDERING TOOL HEATED BY ELECTRIC ARC INSIDE

A soldering iron with an electric arc inside of it for the heating element is being used for some kinds of repair work in Europe. The rear surface of the copper head forms one arc electrode, the other being a carbon rod adjusted by hand. Except for a small gas opening, the arc is entirely inclosed and insulated with porcelain. It takes three minutes from the time the arc is struck to heat the copper to the right temperature for soldering. With a small resistance in circuit for steadying the arc, the implement uses 625 watts at 125 volts. The arc itself operates at 40 volts, the remainder being consumed in the resistance.

PHILIPPINE LIME AND QUARTZ ENCOURAGE GLASS INDUSTRY

Consumption of common glassware in the Philippine Islands has increased so rapidly of late years that there is a movement in Manila to establish local glassworks. Good limestone of coralline and crystalline composition is available in all parts of the islands, especially extensive deposits occurring near Manila. Veins of solid quartz are plentiful in Mindoro, while great beaches of quartz sand offer an inexhaustible supply. The Philippine Bureau of Science has produced some excellent experimental glassware, which has successfully met all tests.

FRENCH AIRMEN INSTRUCT JAPANESE AIR SERVICE

The reorganization of Japan's air service is being supervised by a delegation of veteran French fliers, who are in this way fulfilling a promise, made by their government during the war, to render such assistance on cessation of hostilities. For equipment, the mission has brought 100 French planes and the personnel comprises 20 men and 17 officers, each officer wearing several decorations for merit and bravery.

¶The New Zealand postal service proposes an aerial route from Auckland, over the Wellington Strait, to Dunedin, 700 miles to the south.

THE EYE BEHIND THE LINES

How Battles were Lost and Won According to Superiority of Contending Forces in Aerial Photography

By DOUGLASS REID

Part III.—How the Camera Conquered Camouflage

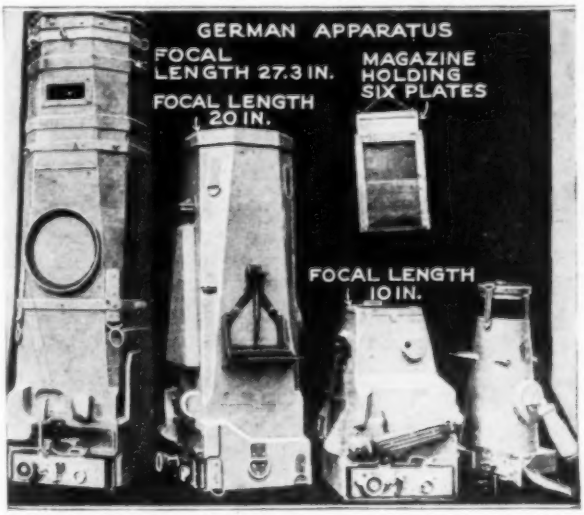
THE trenches! The air is shaking, reeling, tearing; the ground is heaving, flying, collapsing. Fire, mud, metal sear and splatter everything. Orders are shrieked, and the commander disappears in a shell clap, while the men who carry them out topple carelessly to the ground. Great cannon flash noiselessly, so lost are their voices in the deafening roar of other guns. Brown squads of men leap over a ditch top and vanish in the smoke. Wires break, airplanes come crashing to earth; wires break and telephone men throw up their hands; wires break and a stream of enemies come lunging through a gap in the barbed strands. Bones break, bayonets break — hearts break.

All is confusion. "Where is the Eighty-Ninth? Where are the Fusileers? Where are the Zouaves? Is Hindenburg through on the left? Did Colonel De Rescke win Marmont farm?"

Chaos has come!

Through such scenes the spies of the air, the camera men, sped on their daily tasks during the great war. In the hit-trip-smother of that most infernal of all human agonies, trench warfare, the camera detectives of both allied and German forces worked with desperate speed, yet with cool, scheming, studious brains, for on them the infantry commanders relied for precious information. The side whose air photographers were best won the war.

That the last great German drive failed last summer was due to the fact that the allies had the mastery of the air, and the mastery of the air meant complete information, through the camera, as to the enemy's plans. Long-range reconnaissance and battery photography were invaluable in forestalling coming offensives, but trench photography meant actual battle pictures, hurried snaps taken in the heat of conflict, when the guards were down, the masks thrown off, the shells screeching, the men coming. Then the camera was put to its severest test, for telephone and telegraph lines were smashed, dispatch riders shot, observation balloons burned, all other sources of information crippled. The side that owned the air then, had an incalculable advantage, for every 15 minutes a plane would come winging back to its photo-section headquarters to drop a series of photographs showing the progress of the battle.



German Cameras Salvaged from Fallen Planes and Used against Their Former Owners: Optically and Mechanically Not Inferior to Allied Apparatus, Except in Focal Length and Magazine Capacity, They Had One Advantage in Their Four Interchangeable Shutters with Different Apertures

For instance: The "Yanks" are to attack before Sedan at 5:45 in the morning. The photograph men in their dugout clear away all nonessential pans and fluids, the developer is ready, the printing frames and lights tested, the cameras adjusted, the airplanes poised. The attack begins. The field becomes Bedlam! An enemy barrage falls, the American barrage creeps ahead of the charging "doughboys." At the head of each platoon marches a lieutenant in khaki, in his left hand a photograph of the objective, in his right a re-

volver. The photograph is more important, for it has been obtained by the cam-

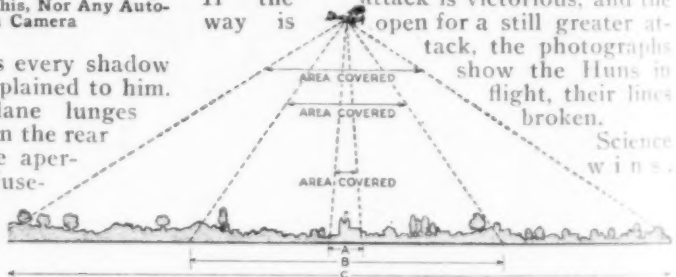
FRENCH APPARATUS
AUTOMATIC FILM CAMERA FOCAL LENGTH 9.6 IN.
TELEPHOTO CAMERA FOCAL LENGTH 20.8 IN.
SIGHTS WITH CROSS WIRES
FOCAL LENGTH 10.4 IN.
FOCAL LENGTH 20.8 IN.
FOCAL LENGTH 47.23 IN.

Of These French Cameras, the Big One, at the Right, Records a Man's Trail across "No Man's Land" from a Height of Four Miles—Comparatively Safe Flying. The Germans Had Nothing Like This, Nor Any Automatic Map-Making Film Camera

era men weeks ago, and its every shadow and high light carefully explained to him.

At 5:50, the first airplane lunges forth and the camera man in the rear seat, glancing through the aperture in the bottom of the fuselage, begins to shoot pictures rapidly. At 6:05 the second airplane follows. At 6:20 the third goes out. As it roars up, the first airplane comes shooting back, having photographed the progress of the doughboys, their enemies, and the effect of both allied and German artillery fire. This first plane does not land; it circles over the photographic headquarters, and the camera man, leaning out, lets his plates fall on the end of a parachute. Then the plane wheels and darts back into the spitting, rocking air above the field. Six-thirty-five, and a fourth plane goes up as the second plane returns to drop its plates. Within the photographic dugout the plates are developed frenziedly; prints are made, and snatched wet from the frames. The "printer" dips the first picture in alcohol, touches it to a tiny gas flame and, as it burns, whips it suddenly downward, putting out the blaze, and tosses it dry to the photographic officer, who numbers and labels it, and in turn throws it to the motorcycle rider, who "crack-cracks" away to the general. The picture is in headquarters 20 to 30 minutes after the photographer took it over the battle field. The prints now flow in a steady stream into headquarters, the photographic division is moving like clockwork. The attack is successful and headquarters moves ahead. The photographers swarm out of the dugout, leap into a motor lorry, with their instruments, bottles, and cameras in their arms, and bounce forward to a new depot.

All the time the scout and observation planes are watching the battle and reporting to headquarters direct, but their word is at best confused and often conflicting. The main reliance is upon the photographs, for they do not lie. If the Yankee barrage is cutting its own men to pieces, the camera shows it; if the attack is defeated, the camera shows the men huddled in shell holes, or lying dead on the ground. If the attack is victorious, and the way is open for a still greater attack, the photographs show the Huns in flight, their lines broken. Science wins.



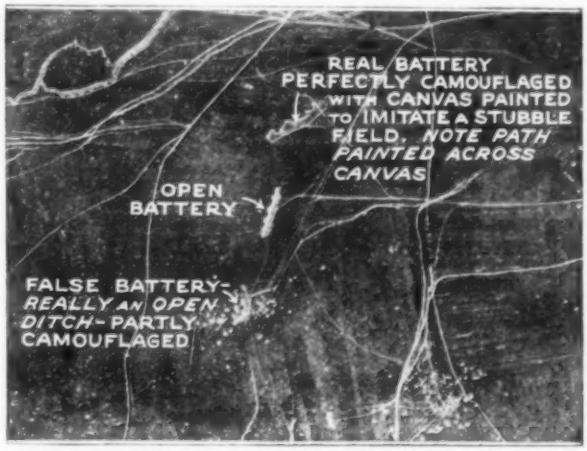
Showing areas photographed by different-focus lenses on 5x4" plate at same altitude.
A. Telescopic lens
B. Ordinary lens (6" to 12" focus)
C. Short-focus or wide-angle lens

A **B** **C**

In Taking Pictures of Hostile Territory the Scout Usually First Covers a Large Area with a Short-Focus Lens. Any Suspicious-Looking Parts were Then Photographed with an Ordinary Lens, Revealing More Details and, Suspicions Confirmed, the Main Object would be Clearly Brought Out by the Telephoto Camera, as Indicated Here

The photographic planes drop out of the skies like blackbirds at the discharge of the farm boy's shotgun, but others take their places and the work goes steadily on.

The whole system of attack in trench warfare was based on photographs. The pictures located the enemy's centers of resistance in the puzzling network of trenches—an all-important thing, for the German system was, in case of attack, to desert certain sections of the trenches and fall back into strongly fortified centers, to let the attackers count themselves victorious and, swarming on past, be caught in cross fires from these centers and annihilated. In the early days of the war, the "Princess Pat's," Canada's pride, were tricked so, permitted to penetrate past these isolated centers of resistance, and then killed to a man by bullets in the back.


REAL BATTERY PERFECTLY CAMOUFLAGED WITH CANVAS PAINTED TO IMITATE A STUBBLE FIELD. NOTE PATH PAINTED ACROSS CANVAS
OPEN BATTERY
FALSE BATTERY—REALLY AN OPEN DITCH—PARTLY CAMOUFLAGED

Having Wasted a Fourth of a Ton of Shells on a Partly Camouflaged False Battery and Silenced an Open One, the Allies were Still Exposed to a Galling Fire from This Point. The Camera Showed Nothing But a Stubble Field, with Uninterrupted Paths Crossing It, but the Filter Lens—the Unerring Analyst of All Camouflage — Discovered the Secret of the Canvas-Covered Battery

In the later days of the war, the allies, holding control of the air, photographed the Hun lines in detail, spotted these centers of resistance and singled them out for bitter shelling, with the result that when the attack was made, the infantrymen, discarding the lightly held sectors of German trenches, concentrated on the centers, took them, and routed the Germans.

The famous Hindenburg line, which allied infantrymen agreed could never be taken, was taken because the allied photographers, by deduction and detective work, spotted the centers; because they discovered and worked out the strength of German forces carefully hidden in dugouts; because they revealed the position of trench mortars, machine guns, tank traps, camouflaged trenches, batteries, ammunition dumps, and the thousand and one other things that marked the activities of the enemy.

BRIGHT SPOTS IN SHELL HOLES ARE HELMETS REFLECTING SUNLIGHT
TRENCH SYSTEM TAKEN BY "LOST BATTALION"
SHELL HOLES FILLED WITH SNOW

In an Unsuccessful Attack a British Battalion was "Lost" after the Retreat of Its Regiment. To Locate and Relieve It Was Imperative. A Camera Scout was Sent Out. Snow had Fallen and Filled the Shell Holes, but in Some the Camera Recorded Reflections of the Bright Morning Sun. These Were Helmets: The "Lost Battalion" was Found, and a Quick Sortie Rescued It

An amazingly detailed chart and "plot" of the entire Hindenburg system was made — a painstakingly mapped revelation of his defense works.

How many lives the camera saved will never be known. When it came, the awful toll taken by errors in judging the condition of barbed wire ceased. In the early days, commanders had to rely on observers for reports as to the condition of these barriers. Mistakes were common, for the eye of an aerial observer is at best faulty. He

might report that the barbed wire in "No Man's Land" looked thoroughly shattered, and that the allied artillery had blasted

increased its length sufficiently to let it cross handily.

When, next, the Huns fixed at cross-

From Right to Left, the Disks Represent the Various Colors as Photographed by an Ordinary Lens upon a Common Plate, with a Panchromatic or Red-Sensitive Plate, and by the Use of a Specially Prepared Color Filter. Upon the Different Effects, as Here Shown, is Based the Color Analysis Which Penetrated the Perfect Nature Imitation in Camouflage the Huns Believed They had Accomplished

the German trenches as well. Headquarters, on his report, would order the men over the top, only to meet an unruined zone of wire, to be held up by it, and shot to pieces by German machine guns that had weathered the allied fire. When the camera came, headquarters learned to wait until the photographs showed the wire unmistakably gone, when every shell hole in "No Man's Land" overlapped another.

At the crack of dawn, before an attack, allied cameras photographed the objective, and if any Huns were left after the bombardment and had come up to meet the assault, the prints caught them.

In this way the camera made cavalry obsolete, for it surpassed this picturesque branch in all of its former-day achievements. What cavalry was maintained in the great war was a more or less sentimental concession to the glowing memory of the gallant and hard riders of the type of Murat, Phil Sheridan, and "Jeb" Stuart.

If a surprise attack was to be made, the camera gave the infantry a detailed map of the vulnerable points, showing where the large dugouts, sheltering from 18 to 20 men each, were located, and where the small dugouts, housing nine to a dozen men, were. It showed them just where the Germans had placed sandbags to cut off a captured trench, and where the machine guns were which could enfilade the captors.

When Von Hindenburg, frightened by the success of the tanks at Cambrai, widened his trenches in order to trap the iron monsters, the camera detected the move, and when the tanks came again each had a special snout on its end that

roads carefully camouflaged "pits," which would break down under the weight of the tanks and precipitate them into captivity, the camera, through its special lenses for the detection of camouflage, caught the trick and gave warning to the tank drivers. When, again, Hindenburg placed automatic antitank guns at roadsides, with electric batteries to set them off when the passing monster sprang the switch, the camera ferreted out the hidden cannon and again the tanks were saved.

This matter of detecting camouflage was most vital in trench warfare, and, mechanically, the solving of the question is the camera's biggest feat.

The Germans were uncannily adept at camouflage—no more so than the allies eventually, but at first they were a step or so ahead. They used color shrewdly.

Now it is a very prevalent idea that all creatures see about the same thing when they look upon the earth. But science proves that different animals see different things; that man sees differently in other ways, and that the camera is more truthful than any eye.

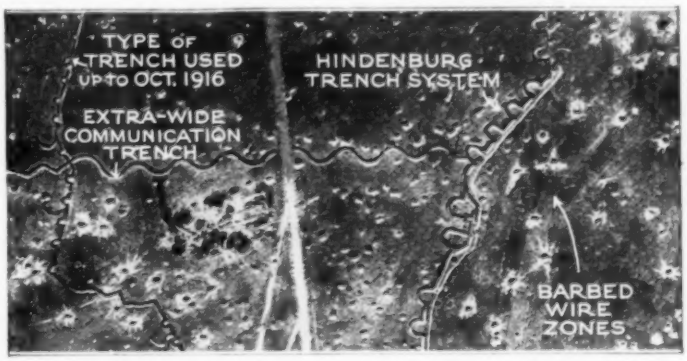
The grocer's horse will stop with unerring precision before the usual door in a row of houses which are so exactly alike that the driver has always to consult the number. On the other hand, the horse will know his master when the man masquerades in a false mustache, while the master's dog will go crazy with fear. And yet, if the master dons woman's clothes, the dog will not be troubled, but the horse will have grave suspicions.

The camera, in detecting the masquerading tricks of the Germans in the war, was as unerring always as the man was

at times, the dog was at other times, or the horse at still others. The camera that the allies perfected saw colors that man does not see at all. The camera shows the golden, fluffy hair of a girl almost black, and the blue-black hair of an Indian gray. The camera catches the band of ultraviolet in the rainbow that is invisible to the human eye. If an ultraviolet monster were to appear we could not see it, but the camera would photograph it.

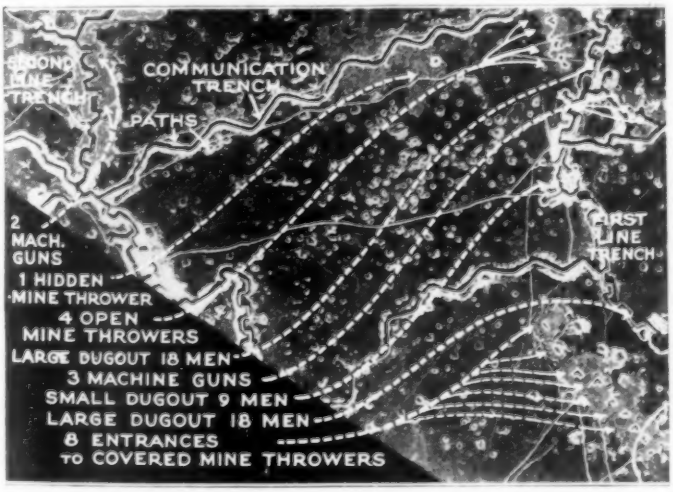
The ordinary camera sees blue best, but science worked out a panchromatic plate which, while still being most sensitive to blue, sees other colors so well that it defeated German camouflage.

For instance, a stereoscopic picture shows a suspicious depression close behind the German trenches. Has it a battery hidden in it? The whole field is smooth and green, having looked so innocent that it was not shelled. In reality it contains a battery covered with green canvas. The green paint blends perfectly with the green grass. However, it wouldn't fool a cow, and it doesn't fool the camera when a special, green-filter lens is used, for the plate shows the green grass in its pure color, while it shows the painted canvas impure and distinct. The green paint is a mixture of yellow and blue, and it photographs vastly different from pure green. Immediately the artillerymen are shown the trick, and they drop shells on it, while the allied truck drivers roll merrily along some road within their own lines that the Hun battery was planning to shell.



The "Unbreakable" Hindenburg Line Is Here Shown in Contrast with the Earlier Trench Form. Lined with Concrete and with Dugouts 20 to 30 Feet Underground, It Was Practically Shellproof. Yet It was Broken, and the Tanks Did Their Part. Not the First Ones, However, for They could Not Cross the Extra-Wide Communication Trenches. Then They were Equipped with a Beak or Skid, in Front, and Gaps, Barbed Wire, "Pill Boxes," Nor Machine-Gun Nests could Stop These Modern Juggernauts

Any color used in camouflage can be detected by color-filter lenses, which resolve the component hues into separate parts. Nor is the witch vision of the camera limited to defeating camouflage. Suppose you were a photographer flying over the Hun trenches on a day when the blue haze dimmed everything. An ordinary lens is helpless, but you put on a yellow lens, and this, holding back the blue rays, takes a sharp, clear view of your objective. In the heavy atmosphere of northern France, the prevalence of this blue haze at low altitudes made this yellow filter a most important adjunct to the camera, and many an attack was carried out or withheld through information given by its fog-piercing power.



Their Equal in Bravery and Equipment, the Hun Lacked the Shrewdness of Deduction Possessed by His Allied Adversaries. To the Latter This Photograph Revealed Not Only All the Facts Lettered into the Picture but Also That the Position Was a Junction Point of One Bavarian and One Prussian Battalion, All Matters of Prime Importance in Preparing an Attack

A dummy of a dead horse placed in "No Man's Land" fooled the allied observers, but the color filter showed that it

was a painted iron replica housing a sniper. Yellow curtains, spread in a stubble field over crouching men, became a distinct, open subterfuge to another filter. Concrete emplacements for machine guns, "pill boxes" as they were called, were painted the color of the earth, and yet the many-hued lenses sooner or later showed them for what they were.

Once Germans hollowed out a mountain, fitting it for luxurious quarters for 1,200 men—electric lights, billiard tables, bathrooms, music rooms—putting a small rock-colored canvas over the little entrance. A French photographer, Collier by name, attached to the "Blue Devils" at the time, found this camouflage speck by his color filters, suspected something, told the artillery, and the latter bombarded the tiny mark. Finally one shell made a direct hit, plunged on down into the interior and, exploding, fired some stored ammunition and killed every one of the 1,200 Huns within. The ruined mountain is named "Collier's Hill" today.

The trail of the human foot is, in trench photography, even more important to the clue-hunting camera man than in long-range and battery work, for the trenches are the honeycomb of walking men. The allies learned to catch the thread of narrow-gauge railways near the front by the telltale whitening of the ground between the tracks, made by men pulling the ammunition-laden cars, after the locomotives had been taken off when the trench zones were reached.

When the allied infantry had gone over the top, the cameras would often lose the men because smoke would screen the field. They had only to wait, however, until the smoke cleared, to photograph the scene, and, picking up the footprints of the soldiers, trace them to their objective.

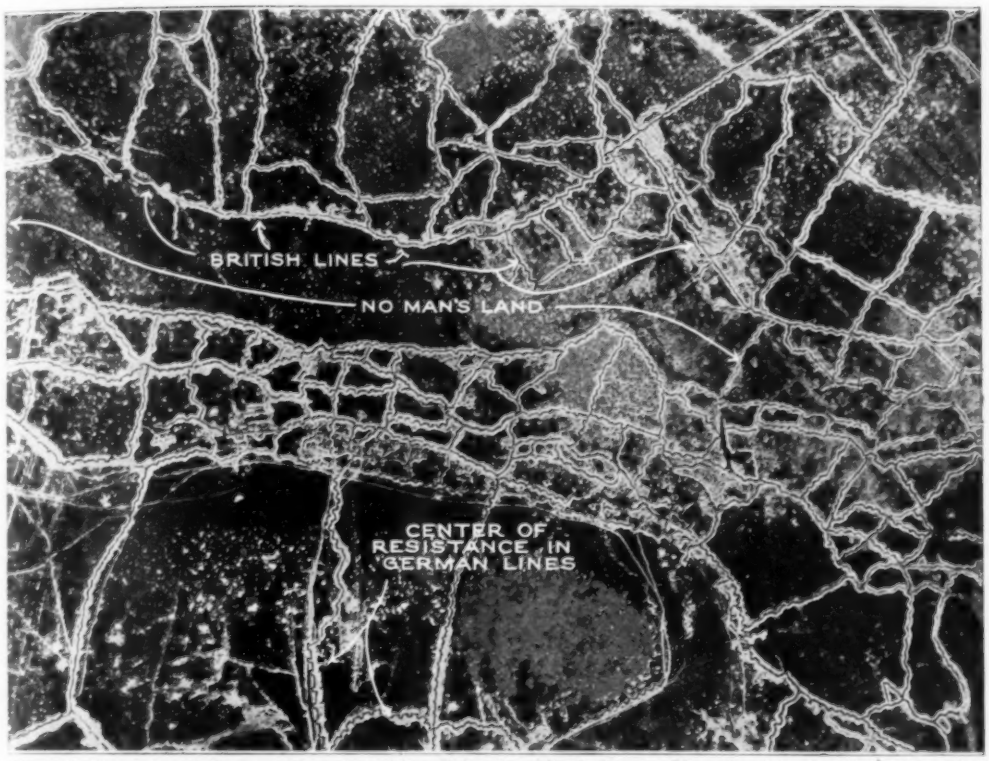
Once the English "lost" 400 men. The charging Tommies got beyond their objective; had their communication lines cut; couldn't be seen from scout planes, and were given up. A series of photographs were made with a special long-focus camera, and on the highly detailed picture their trails were traced through the maze of tracks, and lo! the camera caught the dull glint of their helmets in shell holes where they had dug themselves in.

Always the camera told just how the attacking allied men were digging themselves in, showing at 15-minute intervals the progress of their work of connecting shell holes into a defense trench.

On one occasion the British were preparing for a raid on a large section of German trenches in a quiet sector, and under cover of night brought up "shock" troops along much-traveled roads so that no proof would exist. They lay in hiding all day, and the next night the commanders forbore to send out any scouts for fear their discovery might arouse suspicion in the enemy lines. At the first break of day they sent over a photographer to "snap" the German lines, to make sure that all was quiet. He returned, and his first picture showed two fresh trails running clear across "No Man's Land" from the Hun to the British lines. The British commander, satisfying himself that none of his men had stolen across in the night, knew that a German scout had slipped over and back, and that in all probability he had spread the alarm. Consequently he withheld his attack and sent the photographer back with the special long-focus camera. The new pictures showed a faint widening of the beaten trails between the rear German trenches and the wagon road. Close scrutiny revealed that the Germans had brought up hundreds of fresh soldiers during the night, and had marched them, Indian file, into the trenches—each man walking in his leader's footsteps in order to fool the camera. But the footprints were obviously too large and too deep for one man, and showed the trick.

The British called off the attack while the photographers searched the German lines for miles around to discover where the reinforcements had been secured. Ten miles to the east, they found tracks made by men walking in the same way, Indian file, from the trenches out to the wagon road, evidently to motor trucks. Here, then, the line had been weakened, and acting promptly, the British commander ordered an attack in this sector with the result that the lightly held trenches were captured.

Trench photographs betrayed the enemy's excavations in that it showed where he was putting his soil. It was the German custom, when sinking a mine under "No Man's Land," to carry the earth back and scatter it on the tops of trench parapets, or on the rear slope of a parapet where it would be unnoticed. The color of this fresh earth showed in photo prints, or if it had dried out before the camera caught it—a rare thing—it would show because the parapet would be unnaturally high. When the photographers detected this, they knew a mine was going out in the vicinity, and immediately the



Through Networks of German Trenches, Like This, the Allied Camera Men Persistently Hunted to Find Their Centers of Resistance. These Were Strongly Fortified but Not Conspicuous Positions Which the Huns could Hold Even if the Remainder of the System was Swept Away by the Enemy, and from Them They could Turn upon the Attackers a Murderous Machine-Gun Fire from Behind. So It Was Vital to Discover and Capture Them before Advancing Farther

allied miners would start a counterexcavation.

So it went year after year, the Germans using much the same methods as the allies in trying to use and to fool the camera. Mechanically the Hun was the equal, if not the superior, of the allied photographer. He had on the whole better equipment, and was about as daring in the taking of pictures, but he was never so shrewd at deduction, never so uncanny in his reading of prints; he never had the detective's eye as did the keener, more quick-witted specialists of the French, British, and American forces.

In cameras both sides were much alike, for no sooner had one opponent introduced an improvement, than the opposition would find it on a captured plane and adopt it. Both sides were eager to shoot down photograph planes, for on the dead man's plates, if they were not broken, they could read just what the enemy was spying upon, just what he was after.

The German lenses were of a brilliancy and correctness that the allies seldom duplicated. True to the tedious accuracy of the German brain, the formulas they employed in making their lenses were true to a mathematical nicety, and the workmanship was flawless. Lens astigmatism was unknown among them. Each part of their 13 by 18-cm. (approximately 5 by 7-in.) plates was equally within the sharpest focus. Their lenses never caused that extra rim of light, known as aberration, about objects.

In focal length, however, they fell far short of the allies, and allowed the latter to ride at twice the height and get equally good pictures. The Hun policy was to fly lower, with a flock of protecting planes, while the allies worked in smaller groups and "snapped" from greater heights.

The size of the opening in the shutter was another difference between the combating cameras. In the French, British, and American cameras the size of the aperture was fixed before the airplane left the ground. The Germans had four fixed sizes, which he could interchange in the air. The allied flier had to use whatever he had gone up with. This meant that,

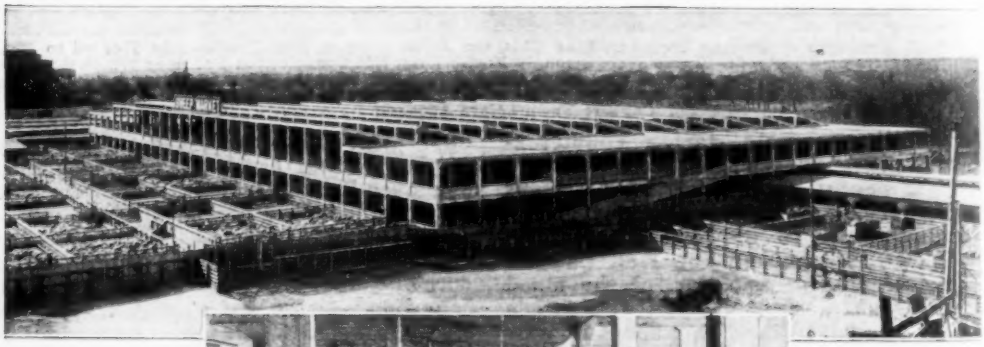
if a sudden change in the weather occurred, or if anti-aircraft guns forced the plane higher where the air was brighter, he had to come home. Many a gallant allied photographer, choosing to fly lower and get his pictures at all costs, died in the attempt. The Huns never used the map-making camera as did the allies, and its neglect cost them heavily before the war was done. The German plate holders contained six plates; the French Gaumont holder, 12; the British "C"-type holder, 18, and their "L"-type, in use when war ended, 24. The United States holders, the De Pam, characteristic of the giant scale on which America worked, held 50 plates.

In bravery, the photographic fliers on both sides were equally matched. I have never talked to an allied camera man who did not pay tribute to his German rivals. In the air the Hun was not a Hun, take him by and large. Whatever there may have been of sporting blood in the German nation showed in the air, and in the air only. Perhaps it was that mysterious exaltation, that thrilling call of the upper air, that subdued the brutishness of the typically militaristic German. Throughout the war the opponents forbore, in the main, to attack the hangars and photographic headquarters of their enemy. Chivalry ran strong in the blood of the men who were "riding with Death" day in and day out.

And braving much for the sake of humanity, the allied fliers have performed wonders for science. Their development of stereoscopic and color photography will be applied to everyday uses in infinite variety. What cannot we now learn of inaccessible deserts and polar regions, what cannot we now discover of the vast depths of the Amazon jungles, the fabled plateaus of Tibet, the untrod heart of the Sahara?

When, later on, we smile to recall how primitive and awkward was the world's fumbling with photography before the war, and reflect on its huge growth, may we do proper honor to those of the hard-riding pioneers of the clouds whose bodies came down, but whose souls went straight on up to the Open Gates.

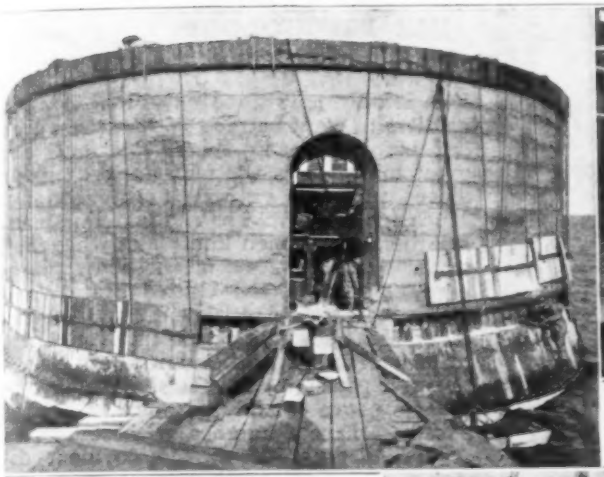
DENVER HAS TWO-STORY CONCRETE SHEEP SHEDS



The Extent of Denver's New Two-Story Sheep Sheds may be Realized from the Upper Picture, in Which One of the Runways to the Second Floor is Seen. The Entire Structure Is of Concrete. The Lower View Reveals the Home Life of Some of the Big Apartment's Temporary Tenants

Enormous sheep sheds two stories high and built of concrete, have recently been completed in the stockyards at Denver, Colo. The capacity of the pens is 70,000. These are asserted to be the largest sheep sheds in the United States, and their facilities establish the city's claim to the honor of third place among the sheep markets of the world, although it is but 50 years since the first settlement appeared there. Sheep receipts during 1918 amounted to 34,119 cars and Colorado itself has over 2,000,000 of the animals. The total cost of the new sheds was $100,000.

TILTING WATER-INTAKE CRIB RIGHTED WITH THREE HUNDRED JACKS



House-Movers' Jacks in Place for Righting Tilted Crib, with Wooden Shutters Hung from Top of Masonry to Keep Waves Out: Shutters at the Left are Seen Lowered into Place

The Heavy Wooden Braces Kept the Big Masonry Cylinder from Slipping Sideways When the Jacks had been Inserted in Holes Blasted to Receive Them

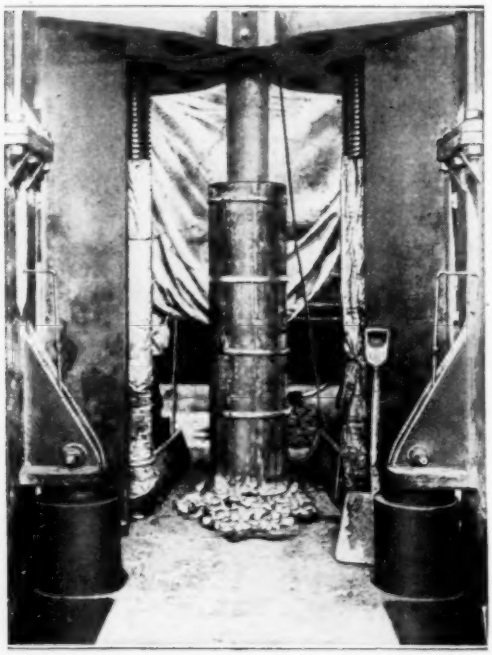
The White Rectangles at the Top Edge of the Crib Are Targets. By Sighting Them the Instrument Man on the Platform in the Center could Properly Direct the Jack Men Below

One of Chicago's waterworks cribs out in Lake Michigan was thrown 18 in. out of level by the settling of the steel and concrete caisson on which it rested. The huge masonry cylinder, 70 ft. in diameter, was righted by inserting under it a complete ring of 300 house-mover's jacks, the depressed side being raised 9 in. and the opposite side lowered the same amount. Openings for the jacks were made by boring two holes through from the inside with a steam drill, and blasting out the space between with light charges of dynamite. Jacks were screwed up tight in the openings thus made, protected with plank bulkheads, and another blast made alongside. This process was continued all around the big circle. Wooden shutters hung on the outside kept the waves of the lake out of the slit. In the center of the crib floor was erected a pipe tower topped by a surveyor's level, and about the upper edge of the stone work were placed 24 targets, or scales, marked in 100 divisions. Watching these, the instrument man called his orders to the jack foreman below, who relayed the instructions to the 12 men working the 300 jacks. Lateral slipping of the masonry was prevented by heavy timber braces inside. When the crib finally had been turned into horizontal position, the jack opening was filled in with brick work, and the job was finished. The whole operation took 30 days, and was completed without damage to any part of the structure.

COMPRESS CONCRETE IN MOLD AND STRENGTH INCREASES

That the strength of concrete increases with its density is well known. That this increase may amount to as much as 50 or, in some cases, practically 100 per cent, is indicated by experiments conducted at an eastern university. A cylindrical sheet-steel form, 5 ft. high and 14 in. in diameter, was used, with a 13-in. plunger for making compression columns, and without a plunger for molding ordinary columns. About 12 in. of regular 1:2:4 mix-

ture was put into the form, compressed at 25,000 to 40,000 lb. (160 to 260 lb. per square inch), another 12-in. layer added



Sheet-Steel Mold and Plunger for Making Test Columns of Compressed Concrete, Which were Found to be 50 to 100 Per Cent Stronger Than Ordinary Tamped Columns and to Weigh Only Four Per Cent More

and compressed, and so on. Ordinary columns were made by tamping the form full of mixture in the usual manner, which after 28 days of setting failed under a pressure of 1,774 lb. per square inch. Compressed columns resisted pressures up to 2,680 lb. per square inch, a 51-per-cent gain. Greater compacting pressure and longer drying further increased the resistance.

MAY HAVE SOLDIERS TEACH FARMERS HOW TO PACK

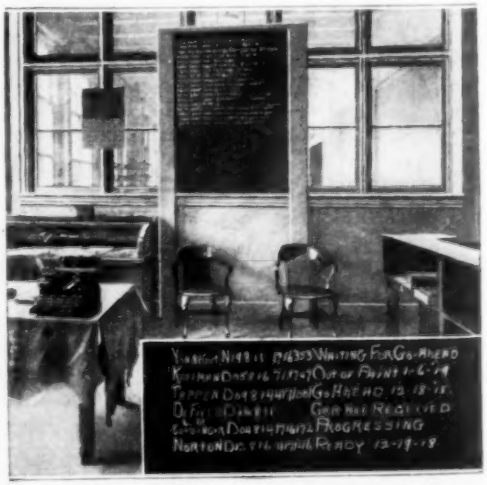
Thousands of dollars are lost every year because farmers are not familiar with the best methods of packing perishable goods for shipment to market, according to statements made at a New York milk investigation. The suggestion was offered that missionaries be sent out to the farms to give instructions and demonstrations in packing. For this work returned soldiers would be available, and could be technically prepared in short order by visits to the big packing plants, where they would learn at first hand the importance of proper methods and the easiest way to pass the information to the farmers.

USE PSYCHOLOGY TO PLACE JOBLESS SOLDIERS PROPERLY

It is only natural to expect discharged soldiers to want better positions than they had before entering the service, but in a great many cases the men are asking for places they are entirely unfitted to fill. Much trouble would be eliminated in placing them if the men knew just what they were fitted for. As a means of overcoming this trouble, the United States Employment Service in New York City has secured the services of a mentality expert to properly classify the various applicants through psychological tests. Should this scheme prove entirely practical, it is proposed to place a number of these experts at the disposal of the employment division.

CAR-REPAIR BULLETIN BOARD ANSWERS OWNER'S QUERY

In the office of an automobile-service station at Indianapolis is a large blackboard, upon which is posted the condition of each car brought in for repair. Notes and changes are made on the board from day to day, so that a glance at it tells the condition of the job. When the impatient owner calls up, the line opposite



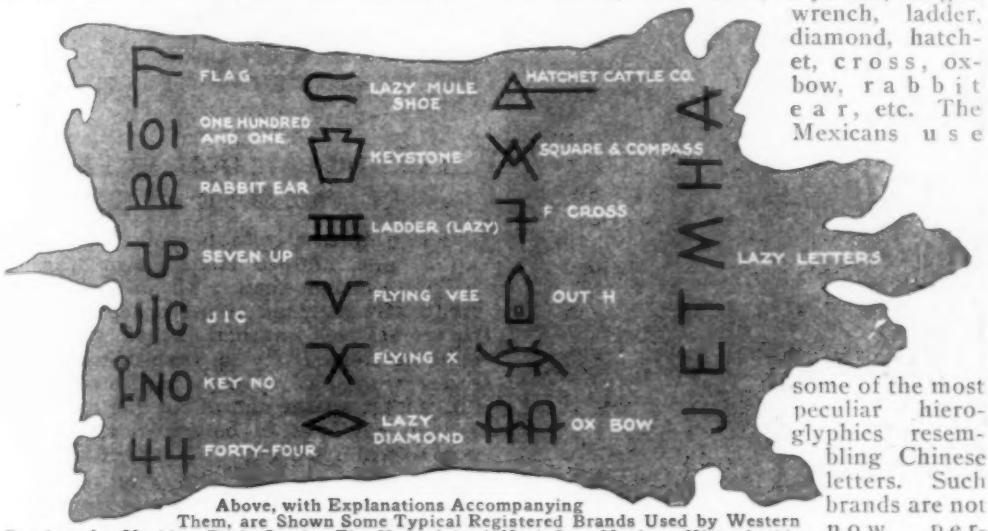
Bulletin Board in Automobile-Service Station Lists Each Car by Number and Owner's Name, and Tells Progress of Work on It, So Manager can Answer Questions Promptly

his name and car number on the blackboard gives the cue for the answer.

WANTED! NEW BRANDS FOR CATTLE

By W. F. WILCOX

THE Colorado State Brand Board has announced that it is "up against it" for new brands. There are between 40,000 and 45,000 different cattle brands recorded in the books of the state, and every day finds new applicants for brands, with none to be had. The various letters of the alphabet and the figures already have been used in about every conceivable combination.



Above, with Explanations Accompanying Them, are Shown Some Typical Registered Brands Used by Western Ranchers for Marking Their Stock. The Unexplained Mark Is a Mexican Hieroglyphic

One thing that stamps the Colorado brand board as unique, is the fact that the same brand is let out to but one person, who can place it anywhere on the body of his stock, while other states where brands are recorded, except California, give out the same brand to six persons, each one to use it in a different part of the animal's anatomy. This reduces the possibility of ever running out of brands.

The "101" brand has probably been burnt into the hides of more brute animals than any other. It belongs to a big outfit which has ranged stock in all the Southwest and is one around which many a story and movie scenario has been written.

In Colorado the brand is practically always on the left side, the left hip usually being the selected place. A roped animal naturally falls on the right side so that the left hip is at once exposed to the brander's iron. Some owners run the brand clear across the whole side of the animal to make it more easily read.

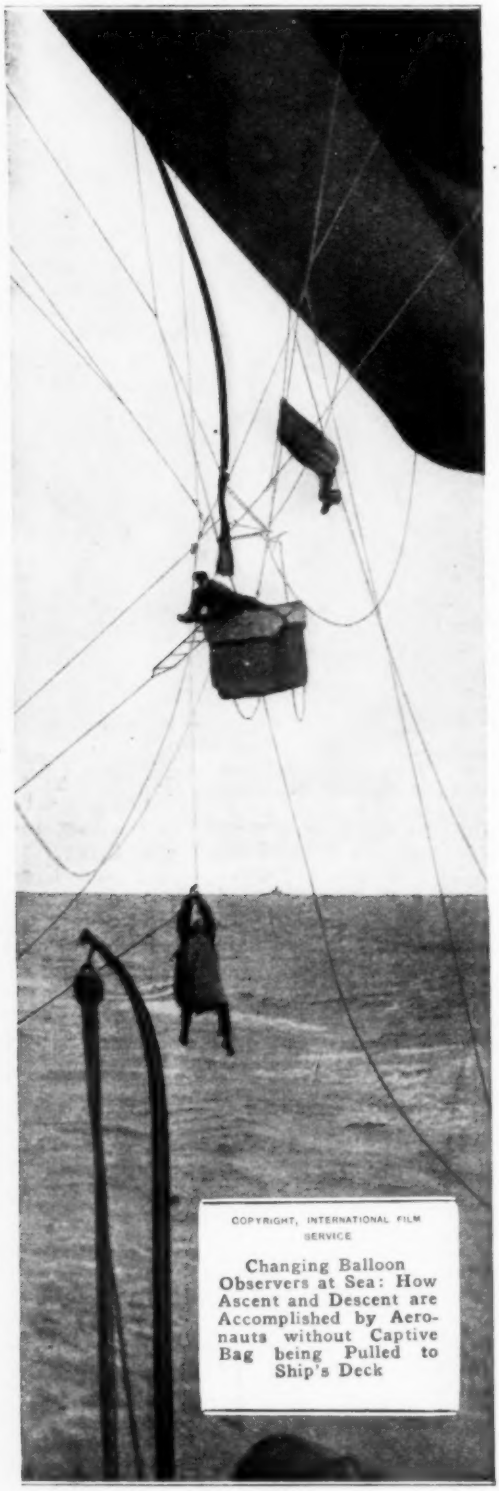
Letters are often used in combinations with a bar above or below, or laid down on their side, when they are known as "lazy" letters. With extensions or wings, they are known as "flying" letters. There are also signs and hieroglyphics used, as the circle, mule shoe, keystone, wagon wrench, ladder, diamond, hatchet, cross, oxbow, rabbit ear, etc. The Mexicans use some of the most peculiar hieroglyphics resembling Chinese letters. Such brands are not now permitted, although those in use for years before recording was instituted are still in use.

The Colorado brand board and livestock associations have inspectors at every shipping point in the state. No shipment of stock, however small, can be billed out without a state inspector's approval. Each year the state board turns over $50,000 to owners for stray animals which were picked up and shipped out with other brands and reported by the inspectors.

Reading brands is a peculiarly difficult job. In the fall, when the hair is long and the cattle are being brought in from the range by the hundreds of thousands, the brand inspector must be able to distinguish any one of all the 40,000 to 45,000 brands.

EAST-COAST MARL DEPOSITS OFFER CHEAP FERTILIZER

Extensive beds of marl and greensand, rich in potash, lie along the Atlantic coast line from Sandy Hook, N. J., to a point south of Richmond, Va. Discovered in 1768, but practically abandoned after the Civil War, these fields of cheap fertilizer



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Changing Balloon Observers at Sea: How Ascent and Descent are Accomplished by Aeronauts without Captive Bag being Pulled to Ship's Deck

have been virtually rediscovered by scientists of the Department of Agriculture. These investigators have found that large shipments of lime are being brought in from other states for use on farms whose own substratum is calcareous marl in unlimited amounts. Transportation from the beds is the element determining their value, but farmers within a few miles of a deposit would find its excavation a profitable spare-time occupation. The soil absorbs the fertilizing factor from the greensand so slowly that a supply sufficient for a long period may be applied at once.

CHANGING BALLOON OBSERVERS IN WAR ZONE AT SEA

To go up to a balloon, instead of going up in one, and to come down from a balloon, rather than with one, is what frequently happens at sea when one observer relieves another aboard a captive balloon floated by a man-of-war. In other words, to change observers, it is not necessary for one of the big sausage-shaped gas bags to be drawn all of the way to a ship's deck. It is pulled in close to the vessel that anchors it, so that one observer can be pulled up, and the other let down, by rope and pulley in breeches-buoy fashion. The advantage of this scheme is that time, always important in the war zone, is saved, and considerable trouble eliminated.

NUMERALS CAME FROM EUROPE, DECLARES ASIATIC STUDENT

That the system of numerals we use and know as "Arabic" had its birth in the ingenious mind of some ancient Hindu philosopher has been accepted as fact so long that to dispute it is to question a cherished tradition. Yet a profound student of Asia Minor and the intellectual characteristics of its various races makes the definite assertion that the Indo-Arabians obtained the symbols with which they are credited, only at third hand, and attributes their origin to the European continent. From this source the Persians adopted them, and later they were introduced by natural diffusion into India and Arabia. Nor did the numerals evolve from alphabetical characters, as supposed, but were designed for their purpose. The investigator's report at least opens the subject to new debate, if it does not wholly dispose of it.

PHILIPPINE TRAVEL—ROMANTIC IF NOT RAPID

The Steed in Harness Is a "Vaca," Used in the Mountain Regions around Baguio, Philippine Islands, in Place of the Carabao

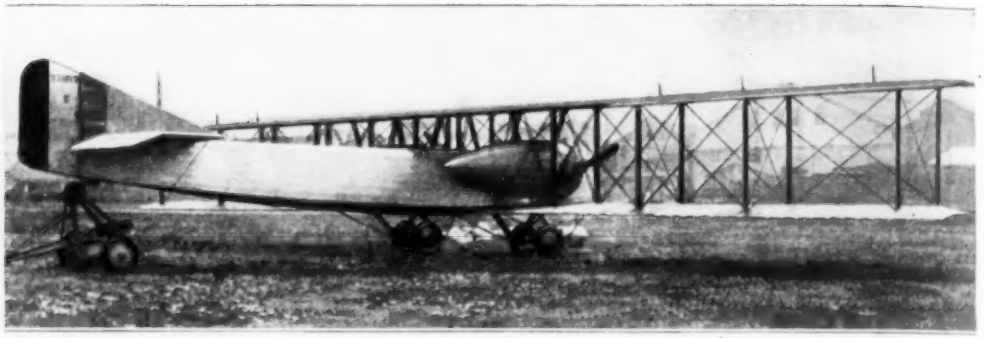
Riding "Horseback" on a Carabao Is the Native Method. The Speed Is Insufficient to Dislodge the Umbrella, Used as a Sunshade

If the Driver Sat Up Behind, It would Be a Hansom Cab; but in the Philippines It Is a "Carromatta," for Hire at 20 Cents an Hour.

Debarking from a Modern Railroad, One Climbs into a Hammock on a Pole, Crude but Comfortable, and Equipped with a One-Man Top. Pennies Pay the Fare

The "Banca," Cousin to the Indian Dugout, Carries Passengers and Freight on the Splendid Island Waterways

The Native Houseboat, Called a "Casco," is Taken Seriously by the Filipino Family Living in It, Who, Indeed, Seldom Go Ashore. A Community of These Craft on the Pasig River, Where There Are Thousands of Them, is Seen in the Picture



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French Bombing Plane Built with the Intention of Raiding Berlin, but Not Completed in Time: It Measures Over 80 Feet from Tip to Tip of Wings and Makes 80 Miles an Hour, Carrying 3,740 Pounds of Gasoline and Oil, and 1,600 Pounds of Explosives

GIANT FRENCH BOMBING PLANE WAS ABOUT TO RAID BERLIN

Civilians as well as men of the air service dreamed, in the days of German aggression, of a bombing expedition that should carry a terrible retribution right to the heart of the Prussian capital. A giant Caudron biplane had actually been made ready for such an adventure when hostilities ceased. The great French plane measures over 80 ft. from tip to tip of its wings. Carrying 3,740 lb. of gasoline and oil, it can fly for 16 hours without landing, making 80 miles an hour and rising to 6,000 ft. For the Berlin raid it would have been loaded with 1,600 lb. of explosives, from a 20-lb. bomb to an enormous aerial torpedo weighing over 1,000 lb. and standing about eight feet high.

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Part of the Cargo of the Biplane Shown Above: Torpedo Weighing Over 1,000 Pounds Which was to have Left Its Mark on the Prussian Capital

VOYAGE ON ICE PACK UPSETS ARCTIC-CURRENT THEORY

Interesting, although incomplete, information comes from Alaska regarding the exploration of currents in the polar basin by Storker Storkerson, who, with four companions, set out more than a year ago to drift with an ice pack from the north of Alaska to New Siberia Island, off the arctic coast of Siberia. The party has lately returned in safety, although without having reached its expected destination. To all appearances, the explorers have disproved the existence of a strong westward current, heretofore accepted by geographers and others familiar with the region. They began drifting after making camp on an ice cake at 73° north and 146° west. The most northerly point reached was 74° north at 153° west. The most easterly point was 144½° west. This indicates that instead of following a fairly straight course, they were carried around by a great eddy. The expedition was originally planned by Vilhjalmur Stefansson, who was forced to turn over his command to Storkerson because of illness. Stefansson believed that an ice pack, which in that region usually has a thickness of from 30 to 50 ft., would drift at a rate of about 200 miles a month and reach New Siberia. The party started in March of last year from Cross Island, traveled with dog sleds for some distance, and then selected an ice cake and set forth. Seals and polar bears furnished most of the food during the novel trip.

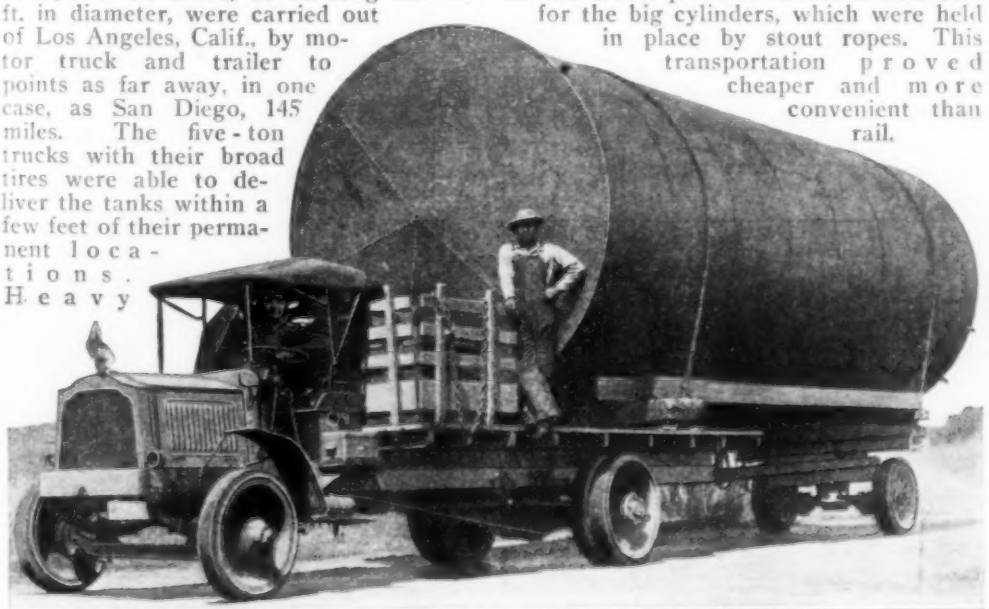
FLOODS CAUSED BY BEAVER DAMS RUIN CROPS

So many complaints have been made recently by Colorado farmers that floods caused by beaver dams in the irrigating ditches had ruined their crops, that the lower house of the state legislature passed a bill sanctioning the killing of these animals when caught destroying property. They have long been under the protection of the state and it is estimated that there are now about 12,000 of them in Colorado. The beaver has always been considered of great benefit. The dams they have built in upper mountain streams have served to store the water and to prevent floods. This has also had a tendency to regulate the feeding of water into the irrigating ditches. Also, those interested in stocking streams with fish have found these beaver ponds very valuable. The fish have first been introduced into the ponds and then, having become properly established, they are permitted to escape or are transferred into the streams it is desired to stock.

Beavers at Work in a Marsh: When a Stream Is Not Deep Enough for Them, They Build a Dam, Often Cutting Down Large Trees for Use in Building It. They are Most Generally Found in Streams Bordered with Thick Foliage

HUGE OIL TANKS HAULED BY TRUCKS

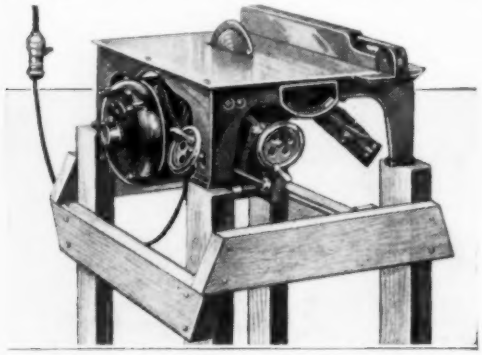
Bigger than the trucks that hauled them, 200 oil tanks, 30 ft. long and 10 ft. in diameter, were carried out of Los Angeles, Calif., by motor truck and trailer to points as far away, in one case, as San Diego, 145 miles. The five-ton trucks with their broad tires were able to deliver the tanks within a few feet of their permanent locations. Heavy timbers laid from the two-wheel trailer to the truck platform made a safe seat for the big cylinders, which were held in place by stout ropes. This transportation proved cheaper and more convenient than rail.



Oil Tanks, 30 Feet Long and 10 Feet in Diameter, were Hauled as Far as 145 Miles Out of Los Angeles, California, on Five-Ton Motor Trucks Equipped with Trailers. The Trucks Were Able to Deliver Their Huge Burdens Right at the Spot Where They were Needed. In This Way 200 Tanks were Transported

BENCH SAW CUTS AT AN ANGLE WHILE TABLE IS LEVEL

To increase production and reduce cost in woodworking shops, a time and labor-saving bench saw, with features that



Connected with an Ordinary Lighting Circuit, the Saw Makes a Full Two-Inch Cut through Hard Wood

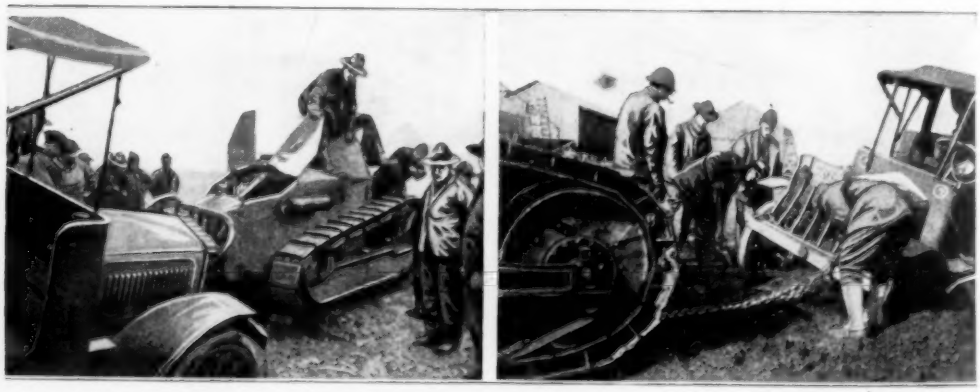
appear to be advantageous, has been evolved. It is portable, electrically driven, and intended to be connected with an ordinary lighting circuit. Equipped with a motor of ½ hp., it is claimed to be capable of making a full 2-in. cut through the hardest kind of wood. The saw is so mounted that it may be tilted for cutting at an angle while the table remains level. By turning a handwheel until the exact angle desired is registered on a dial, the saw is accurately adjusted in a moment's time. Furthermore, the saw may be raised and lowered so as to either cut or groove. A crosscutting fence built into the machine is out of the way when not in use, while the rip fence is finished on two surfaces and may be used on either side of the saw.

FURNACE SALAMANDER CUT BY OXYHYDROGEN FLAME

The "salamander" found in the bottom of a blast furnace consists of unfused iron, slag, and ore, and is extremely hard. The usual procedure to eliminate it is to drill it with a diamond bit, in an air drill or driven by a sledge hammer. A steel company at Cleveland, when blowing out one of its furnaces for alteration and relining, uncovered a salamander two feet thick. An oxyhydrogen flame was used to cut the accumulation, and it was found that the pressure of the gases blew the molten metal out of the hole.

TRUCKS WALLOW IN DEEP MUD BUT TANKS YANK THEM OUT

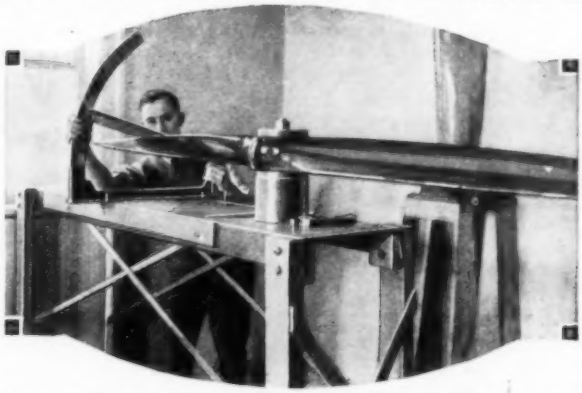
Impromptu demonstrations of the tank tractor's extraordinary energy continue to surprise spectators. At a southern army camp the treacherous marsh soil had a habit of engulfing the lower portions of such vehicles as rashly essayed to cut short the beaten path. When a heavy motor truck thus sank clear to its body, a pair of its mates were quite unable to extricate it. A five-ton French baby tank, however, which was there to help train the tank corps, floated gracefully out on the abysmal mud and jerked the stalled truck out so hurriedly that it slid along on its body, its stationary wheels plowing the depths. Even when the red motor fire engine from town went in up to its waist and defied 25 mules to get it out, the baby tank gently withdrew it at the end of a two-inch hawser. The heavy chain first applied snapped like a thread when the tank set its 130-to-1 gear reduction against it.



French Baby Tanks have Proved Very Useful around a Southern Camp for Pulling Stalled Trucks Out of the Treacherous Soil, Where They were Often Imbedded Up to Their Bodies. Sometimes the Chain Broke, but the Tank Never Failed

HOW THE PROPELLER PROBLEM WAS SOLVED

by E.T. Bronsdon



Measuring the Pitch of an Aluminum-Protected Propeller after Subjecting It for Four Months to the Arid Atmosphere of the "Painted Desert": The Metallic-Leaf Covering Prevents the Wood from Warping, Although the Air Renders an Ordinary Screw Useless in Three Weeks

THE whole truth concerning our DeHaviland-4 war airplane probably never will be published in a popular magazine. When a government learns technical lessons through bitter experience, it sometimes is neither necessary nor advisable to relate the whole grim adventure.

This article does not pretend to reveal the full nature of this last technical lesson. Two faults in the DeHaviland, as it first appeared, came to the direct notice of every Yankee pilot. The first was the matter of faulty gasoline feed, which made the bus prone to fires. This defect was corrected by redrawing specifications, to prescribe one of the two other methods of gas feed; then the epithet "flaming coffin" no longer was deserved.

The second fault was far more mysterious to the pilots, and far harder to correct. When an American plane took the air in France no one could prophesy, with better than an even chance for correctness, whether the machine would return driven by its propeller, or have to attempt a glide and volplane to safety.

A sinister percentage had the experience of mounting to the clouds, starting blithely after Fritz, and then having the wooden propeller suddenly fly to bits! It was found to be no fault of "Archie's," though at first some were inclined to blame hits by stray fragments of high-explosive shell. As a matter of fact, these accidents occurred far back of the lines, and later, when the machine was used at all camps in the United States, similar troubles appeared.

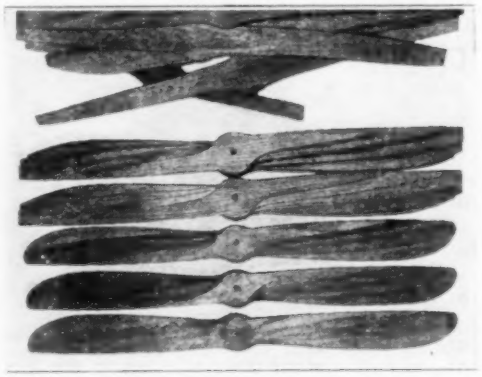
It was discovered, by consultation, that allied plane makers long since had reconciled themselves to the phenomenon. Sopwiths, Nieuports, and all the rest, were hard on propellers, though with these foreign machines a full 50 per cent of the blades outlasted the lives of the respective planes. With American importations, 60 per cent, or more, of the propellers went to pieces almost immediately.

Usually, when a problem is known and recognized, a Yank goes ahead and finds the solution. Undiscouraged by the fact that four European woodworking companies had tried out every means their ingenuity could suggest—even to attempting propellers molded from solid metal—the Forest Products Laboratory of the United States Department of Agriculture tackled the dilemma.

The Aluminum Leaves are Slipped from the Book, One at a Time, by Turning Back the Pages Halfway and Gripping Them between the First and Second Fingers of the Right Hand, While Holding the Book in the Left Hand, as Shown

The crux of the difficulty lay in the fact that a propeller is large. It cannot be made of solid metal, because it would overweight the machine. Wood is by far the best material; but wood possesses the bad fault of having a high percentage of moisture content, even when thoroughly air-seasoned, or correctly dried in a water-spray kiln. Green mahogany or walnut—the two best materials for propellers—contain from 40 to 50 per cent moisture. Seasoned wood contains approximately 15 per cent. Propellers always are made of the very finest stock, because perfect pitch and balance are essential. When sent out from the factory, each propeller is known to be perfect in these respects. The moisture content of the wood at this time is 15 per cent.

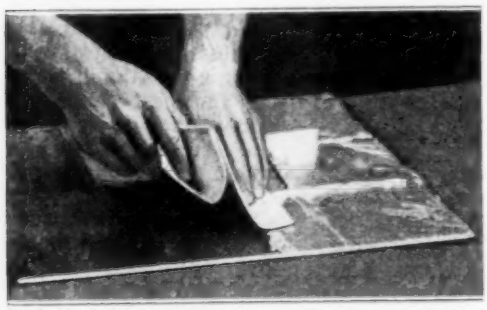
When subjected to conditions of high humidity, after manufacture, even hard wood, like mahogany or walnut, protected by eight coats of so-called "waterproof" varnish, soaked up some additional moisture unevenly. When used in a hot, arid region, the wood lost moisture just as unevenly. This caused warping and change in the pitch of the blades, but—most important of all—it caused the blades to lose balance. Immediately, when driven at high speed by a Liberty motor, they cracked and burst—and one more airman got the chance of demonstrating his skill at volplaning. In stormy weather, over a country where landing was difficult, or during an engagement with the enemy, this was a nasty hazard.



Indicating, from Top to Bottom, Six Steps in the Manufacture of a Propeller: The Five Laminations of Which a Screw is Built, the Members Glued Together, Appearance after Removing Excess Glue, Roughing Out Begun as Indicated at Hub and Tips, Roughing-Out Operation Completed, the Propeller Ready for Inspection and Varnish

The experts of the Forest Products Laboratory succeeded in solving the problem. After a series of thorough experiments had convinced them that no paint or varnish then manufactured could hold the moisture content of a propeller constant, they invented the aluminum-leaf method of waterproofing wood. At the close of the war, all our airplane propellers were being made in this way.

The method consists in providing a mirrorlike surface first. The bolt holes in the hub are plugged with cork, which is cut off flush and finished exactly as the rest. A filler, consisting of spar varnish, turpentine, and 200-sieve silex, fills the grain pores. Then comes an undercoating of orange gum shellac, which is spread evenly, dried, and sanded lightly. Following this is the coat of size. Extreme care has to be taken in applying the size, otherwise the mirror surface will be marred by fatty edges or runs, which will cause the leaf to rub off later.



First Operation in Applying Aluminum Leaf to a Propeller: The End of the Sheet Exposed by Turning Back the Book's First Page is Placed against the Surface to be Coated, and Held Securely in Place with the Left Hand

The aluminum leaf used as covering varies in thickness from $\frac{1}{12000}$ to $\frac{1}{15000}$ of an inch. It comes in packs containing 500 leaves. This is divided into books, containing 50 and 25 leaves, respectively, for ease in handling. The size of the metal leaf placed between the pages of these books varies from 4 to $5\frac{1}{2}$ in. square.

The experts who invented the method found that, in applying the leaf, it should be slipped directly from the book by turning back the first page halfway, holding the page between the first and second fingers of the right hand. The book itself should be held between the thumb and fingers, and in such a way that the back of the hand is toward the work when the leaf is applied. The book is bent slightly to prevent the aluminum leaf from drooping. The end of the leaf exposed by turning back the first page of the book should be placed against the surface to be coated and held securely in place by the left hand. The sheet held between the first and second fingers is then drawn back, to allow the whole leaf to come in contact with the surface. The next sheet is applied in like manner, lapping edges with the first, and so on. The best results are obtained where the gilder works from left to right with each row of leaf, because this simplifies the process of completely smoothing the surface. When the surface is finished, the cork can be removed from the hub holes, and these may be treated with 1-in. strips of aluminum leaf dropped in vertically.

On top of the aluminum leaf go two coats of varnish, the first an undercoating similar to the one described previously and the second an ordinary spar varnish. Then the propeller is ready for use. The

total time involved in the process is approximately 100 hours.

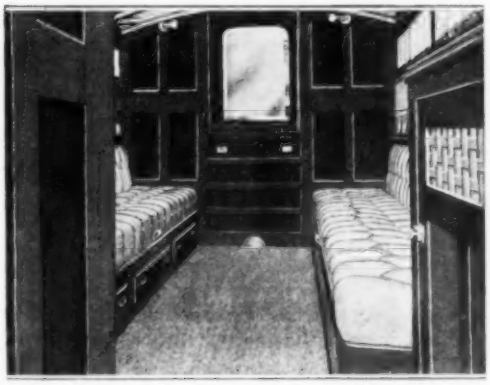
At the Forest Products Laboratory, Madison, Wis., airplane propellers made in this way were subjected to the most exhaustive tests. Chambers were set apart—one a "Sumatra room" (where the air was kept at 100-per-cent humidity), another called the "Painted Desert" (where the air was almost devoid of moisture), and so on, covering all possible climatic conditions—and the blades made to show exactly what they could do. Now, after some of the blades have been in these chambers for several months, they still retain accurate pitch, and little moisture variation is observable.

This process is dedicated to the public. Manufacturers who desire to use it in making articles proofed against moisture are at liberty to do so. In pursuance of its splendid policy, the Forest Products Laboratory stands ready to render further details, advice, and assistance on the adaptation of the process to industry, free of charge. Because no such method ever has been recognized before, the use of aluminum leaf should arouse widespread interest.

Smoothing the Aluminum Covering before Applying the Finishing Coats of Varnish: This Is One of the Final Steps in the Process of Protecting an Air Screw against Adverse Atmospheric Conditions

STANDARD FAMILY CRUISER MAKES UNUSUAL SPEED

Twenty miles an hour is unusual speed for a heavily built 52-ft. family cruiser, yet that is the regular rating for a standardized boat developed for this season. A party of eight and a crew of two are accommodated, all the conveniences of a modern home being provided, including electric lights, running water, screens, velvet carpets and hangings, and handsome upholstering. Controls for the eight-cylinder engine are carried to the steering column on the bridge for one-man operation. Of modified V-bottom design with sawed frames, steam-bent ribs, and battens backing each plank seam from stem to transom, the cruiser is good for extended trips in any water or weather. The engine may be throttled down to a barely perceptible movement for safe maneuvering in a crowded harbor.



Main Cabin of the Cruiser: The Mahogany Paneling, Velvet Carpets and Upholstering, Electric Lights, Drawers under the Seats, and Some of the Lockers Are Visible. The Rest of the Boat is Finished in Equally Luxurious Style

Standardized 52-Foot Family Cruiser Whose Eight-Cylinder Motor Drives It from a Barely Perceptible Movement Up to 20 Miles an Hour: It Accommodates a Party of Eight and a Crew of Two

NEW DERRICK BARGE CLAIMED BEST ON PACIFIC COAST

A new derrick barge, having a 102-ft. boom and a lifting capacity of 75 tons, has just been placed in commission at San Francisco, and is said by shipping men to be the best on the Pacific coast, with the possible exception of government equipment. The boom has two cable connections, one near the top, for light loads, and the other about two-thirds the way up, for heavy lifting. The barge is fitted with pumps, and oil and water-storage spaces for the benefit of vessels at sea, and is also equipped with bunks for about 40 men in the hold. The engineer is signaled for the various manipulations of the derrick by means of an electric bell.

New 75-Ton Derrick Barge Just Placed in Operation and Said to Be the Best on the Pacific Coast: The Derrick Is Shown Lifting a 42-Ton Boiler

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¶ Japan's commercial growth has been so rapid for the last few years that her public utilities have been unable to keep up with the demand. Telephones are at a premium, and the fortunate possessor of one may sell it, if he wishes, for as much as $250 to $750, the value depending largely on the number.

WHY RIPE APPLES AND BANANAS ARE SWEET

The government laboratories at Washington have recently been trying to ascertain why sweet potatoes are sweet and what constitutes a really ripe banana. This is not merely a matter of curiosity on the part of the official chemists, but is of practical importance in these days of cold storage.

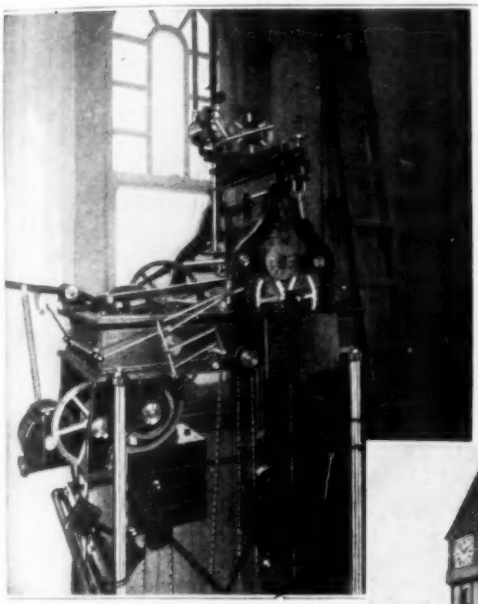
The season of unripe apples and little boys' "tummy" aches will soon be upon us, and we might as well know why the one is so likely to cause the other. It is in apples, as in bananas and sweet potatoes, a matter of starch and sugar. The unripe apple is relatively rich in starch and poor in sugars. As the ripening goes on, the starch gradually changes into sugar. As starch it is indigestible. Before being digested all starch has to be changed into sugar. This process is performed in the human body by the chemical action of digestive juices, especially the saliva.

The process takes place in the fruit itself while ripening. And, strange to say, the natural ripening process is independent of all connection with the plant on which the fruit is borne. This is well known to every gardener who plucks tomatoes or other fruits and places them to ripen in the sun, and to every importer of bananas who gets them green, and puts them in storage to turn yellow.

Some apples are ripe when picked in October; others called "winter varieties," have to be kept for several months. Different species vary widely in the time they take to turn their starch into sugar.

With bananas the conversion is most rapid while they are turning from green to yellow. During this time the fruit "breathes" rapidly, giving off large quantities of carbon dioxide. The peel is giving up its water and the pulp is absorbing it. The banana is ripe when the process of change from insoluble starch to soluble sugar is completed.

NEW PIER CLOCK IN NEW YORK HARBOR STRIKES SHIP TIME



Clockworks in the Lower Part of the Tower, Occupying a Space of Only 54 Cubic Feet: The Small Electric Motor Which Winds Up the Weights may be Seen at the Left

Bell, Striker, and Dials Are Visible Here, as Well as the Spindles by Which the Hands are Turned by the Works Down Below. Below Each Dial may be seen a Reflector Lamp

The Clock Tower on the End of Pier A in the North River, New York: Its Big Bell Strikes Ship Time instead of Landlubber's Time

A big ship clock, which strikes "ship time," and is said to be the only one of its kind in the United States, has been erected in the tower at the end of Pier A, North River, New York City, the headquarters of the city's Department of Docks and Ferries. The clock and bell were presented by a prominent citizen, as a memorial to the army and navy men who gave their lives in the war.

Owing to the prominent location of the pier, which is the first on the New York side of the river, the clock's bell can be heard all over the harbor. By ship time, the clock strikes "one" at 12:30 in the morning, and strikes one more every half hour until "eight bells," or four o'clock in the morning, is reached. It then begins one bell at 4:30 and strikes up to "eight bells" at eight o'clock in the forenoon, and so around the day.

The bell is of bronze, weighs 1,000 lb., and is 37 in. in diameter. It is located in the dial chamber, just behind the four glass dials, each of which is 6 ft. in diameter. At night the dials are illuminated, the illumination being controlled by clockwork, which turns it on and off at set hours.

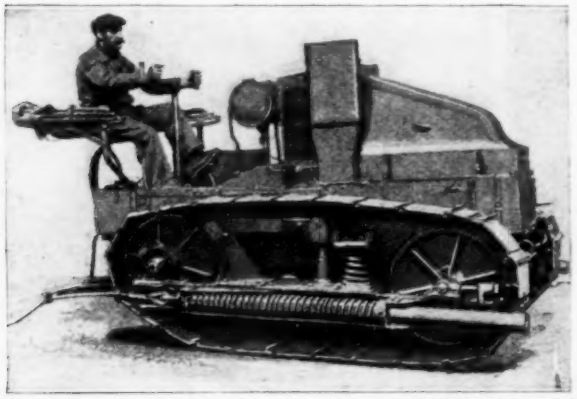
The mechanism of the clock itself, which is located in a compartment below, is very compact. The weights furnish the motive power and are electrically wound in a very small space. The clock weights and winding mechanism occupy a space only 4 ft. long, 3 ft. wide, and 4½ ft. high.

The clock differs from others of its kind in that the strike is accomplished by one hammer instead of two. The striking wheel is constructed to give the necessary length of blows at each hour and half hour, while an automatic stop prevents the striking from going beyond the proper number.

The operation of the dials, from the clockworks underneath, is accomplished by a system of rods and cogs, which makes it possible to examine the works whenever necessary. The main driving spindles extend vertically upward and turn the horizontal spindles of the dials and the striking wheel.

FRENCH BABY TANK ADAPTED TO AGRICULTURAL USES

It has been found that the French baby tank, made in large numbers for military use, can be adapted to agricultural purposes with very slight mechanical change. It was merely necessary to provide mechanism for absorbing the shock and vibration at the drawbar when these powerful little machines are used for hauling farm implements and wagons. This was done by mounting at each side of the truck a longitudinal iron pipe sliding in fore and aft bearings. Surrounding the pipe between the bearings is a heavy spiral spring. An eyelet in the rear end of the pipe serves for connection to the drawbar, which thus pulls against the resiliency of the steel springs. With this slight but ingenious modification the baby tractor is ready for serious peace work.



BY COURTESY OF LA NATURE

French Baby Tank Made into an Agricultural Tractor by Adding Shock Absorbers Connected to the Drawbar: Heavy Iron Pipes at the Sides of the Truck, Sliding Lengthwise in Spiral Springs, Take Up the Unequal Strains of Haulage

DANISH POULTRY THRIVE ON WAR SUBSTITUTE

The war has given Denmark a poultry-food substitute which seems to be, not "just as good," but even much better than the original. It is a meal made from the blue mussels found in great quantities along the Danish coast. Dried at a high temperature and ground fine, a hen food is produced which packs easily, and develops no objectionable odor, if kept dry. Analysis shows a high percentage of nitrogen and lime; while experiment reveals an increase in egg production of over 100 per cent. Poultry soon overcome a dislike for this new food and will eat it readily when mixed with an equivalent amount of barley bran, and supplemented by vegetables. It is suggested that poultry be broken to this new diet by feeding only a little at one time, and giving nothing else until they have eaten all set before them.

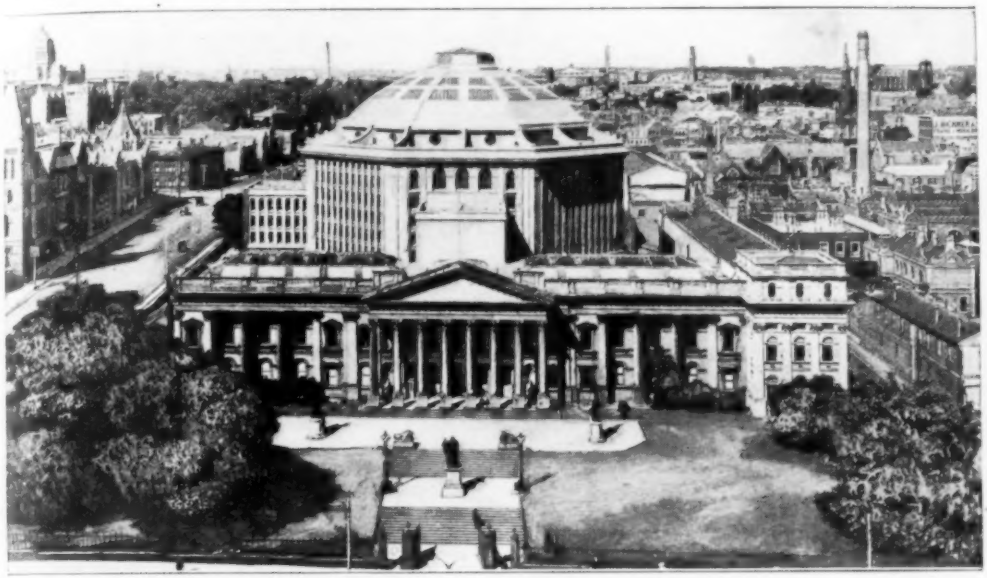
TRY TO STOP YANKEE TANKS WITH STEEL CABLES

As indicating the desperate efforts and devices of the Germans, during the last weeks of the war, to stop the dreaded advance of American and French tanks, a "fence" located in the region of the Argonne-Meuse drive is quite impressive. It consists of huge concrete blocks serving as fence posts, and connected by heavy steel cables, securely fastened by wrapping around the posts. These barricades reinforced the lines of barbed-wire entanglement which had proved so ineffective as tank restrainers, and their construction must have been quite a task.

COPYRIGHT, AMERICAN PHOTO SERVICE

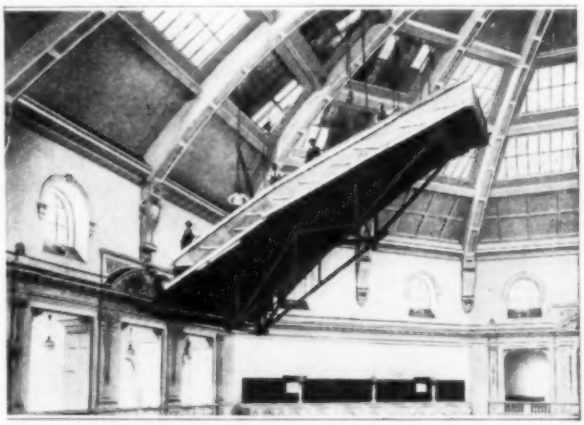
The Germans Expected This Line of Heavy Steel Cable and Ponderous Concrete Posts to Stop the Advance of Tanks of the American and French Forces in the Argonne-Meuse Drive

REPAIR BIG CONCRETE DOME BY USING ODD SCAFFOLD



Public Library at Melbourne, Australia, Whose Reinforced-Concrete Dome is Asserted to be the Largest of Its Kind in the World: It Was from the Inside of This Dome, 114 Feet High, That Plaster Started Falling, Necessitating Relining with Fibrous-Cement Slabs

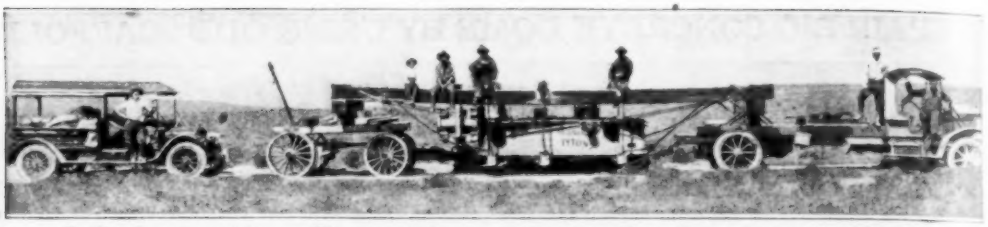
Melbourne, Australia, asserts that its public library has the largest reinforced-concrete dome in the world. Whether or not the superlative is correct, the dome is 114 ft. both in span and height. Unequal expansion of its surfaces for some time has been causing plaster to fall, generally in small bits but with considerable velocity, into the big reading room below. It was decided to reline the dome ceiling with slabs of noncracking fibrous cement, screwing them to wooden plugs driven into holes drilled in the concrete. The scaffolding used for the work was built like a staircase to follow the curve of the dome, and was suspended a hundred feet above the floor, accommodating a large crew of men to speed the work. The dome itself was proved safe by making an accurate miniature model of it, which was thoroughly tested.



Curious Scaffolding, Built Like a Staircase, was Suspended 100 Feet above the Reading-Room Floor, While Cement Slabs were Screwed to Wood Plugs in the Concrete Ceiling

AMERICAN CLUB POSTS SIGNS ALONG MEXICAN HIGHWAYS

An American motor club is posting a foreign country with road signs for the first time on record, it is believed. The club is located on the southwestern coast and has long felt the need for an improvement of this sort in the Lower California peninsula. In consequence permission was recently applied for and received from the Mexican governor, to post signs wherever necessary. The club's crews and cars were recently reported to be at work on the long trip of about 800 miles from the American border.



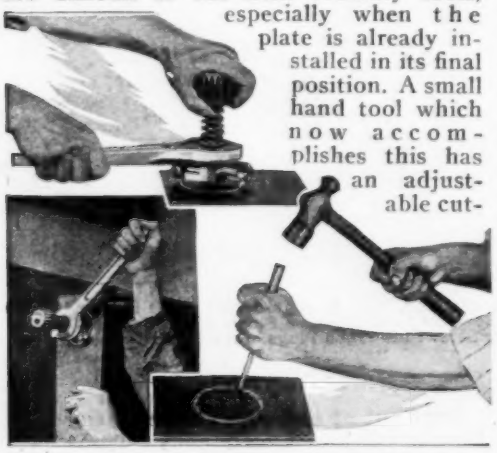
Trailer Improvised from a Wagon and Used with Five-Ton Motor Truck for Hauling 14 Tons of Iron over a Desert Trail: The Iron was Suspended from Heavy Timbers by Bars and Chains, as the Picture Shows

FOURTEEN-TON TRUCK LOAD HAULED ACROSS DESERT

Desert transportation is always a problem out West. Just recently an oil field in Wyoming needed a 14-ton iron engine bed, from which it was separated by 46 miles of sand and sagebrush—and no railroad. A good five-ton motor truck was available, but the load was obviously too much for it. So a strong wagon was converted into a trailer, a pair of long, heavy timbers connecting the truck platform and the wagon bed. The huge mass of iron was suspended from the timbers. Then the truck's driving sprockets were changed to lower the gear ratio, so the engine would not strain itself, and the trip commenced. It was finished in a day and a half, without adventure.

HAND TOOL CUTS BIG HOLES THROUGH STEEL PLATE

Smooth round holes through steel plate are difficult to cut with ordinary tools, especially when the plate is already installed in its final position. A small hand tool which now accomplishes this has an adjustable cutting-blade chuck, enabling it with one set to cut holes from 1¼ to 3 in., and with the other from 1⅜ to 6 in. diameter. A ⅜-in. pilot hole is first drilled through the steel plate and the spindle of the tool passed through and clamped with a nut from the rear, or if that cannot be done the pilot hole is tapped and the spindle screwed into it. A heavy spiral spring holds the cutters against the plate, and the chuck is rotated by a special ratchet wrench, which can be used in corners and difficult places. Regular cutters are heavy enough for 3/16-in. steel, while special blades will cut up to ½-in. steel or 1-in. marble.



New Tool Cuts 1¼ to 6-Inch Holes in Steel Plate. Ratchet Handle Permits Use in Corners, as at the Left, Contrasted with Old Method, at Right, of Drilling and Chiseling

EMBLEMS FOR ALL INVESTORS IN VICTORY LIBERTY LOAN

All subscribers to the Victory Liberty Loan, from the individual buyer of a small bond to the big industrial plant whose employes join in meeting its quota, will be awarded emblems in honor of their patriotic efforts. The Industrial Honor Emblem, for business houses and organizations, is a cambric banner, 30 by 34 in., with a big blue "V" on a white field and a wide red border. Similar to it except in size is the individual subscriber's window emblem on paper, 6½ by 8½ in. When everybody in the household subscribes, the window emblem bears a blue circle inclosing a red "100%," with the words "Household Honor Emblem" in red and "Victory Liberty Loan" in blue.

¶Fine filaments of spun glass are being woven into cloth and felt on a commercial scale at Naples, Italy. The material finds use in the insulation of plates in storage batteries.

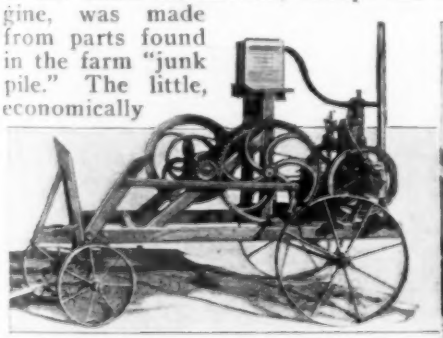
ATTRACTIVE "LOG" BUNGALOW BUILT OF CONCRETE

American pioneers have handed down an affectionate regard for log architecture, and many a city dweller would prefer a plain log cabin to a modern mansion for his country home. A builder in Yankton, S. D., has combined both in a pretty and homelike bungalow whose "logs" are made of concrete. The loglike units are precast separately, flat on top, bottom and inside, but with the outside surface molded round and with an imitation bark finish. Ends are cast with dovetails, and interlock at the corners. Ordinary mortar joints are used, and the exterior is finished to a natural effect with a wood-brown stain, preserving in form all the esthetic value of the rustic model, but with the cleanliness and sanitary value of the modern material.

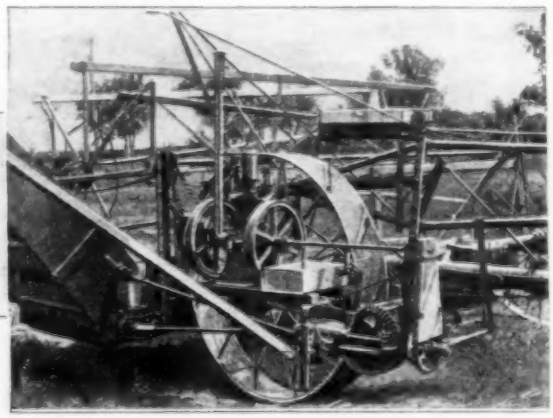
In This Pretty Bungalow the "Logs" Are Precast Concrete Units, Laid Up with Mortar, Like Any Masonry, and Stained Wood-Brown on the Outside to Look Natural

SMALL ENGINE ON HEADER SAVES FARMER'S HORSES

The difficulties of a wet harvest with a horse-drawn header led to the invention, by a Kansas farmer, of an engine drive for the sickle and canvas of the header. A 2½-hp., two-cycle gasoline engine mounted on wood stringers was bolted to the side of the machine and coupled to a series of bevel-and-chain reducing gears. A clutch of automobile type gave the operator control of the power drive from his seat at the rear. All of the extra mechanism, except the engine, was made from parts found in the farm "junk pile." The little, economically operated motor saved the labor of two horses in working the header. A binder was also operated on the same principle. Another application of the engine was running a portable bundle topper, or Kafir header, which has a vertical pivoted blade connected by a pitman to a large gear wheel, turned by the engine at 60 r. p. m. This arrangement cuts a bundle clean at one stroke. Addition of a lever attachment converted the topper into a portable pump jack.



The Little Engine Mounted on the Header Runs Only the Sickle and Canvas, but It Saves the Farmer Two Horses



The Same 2½-Horsepower, Two-Cycle Engine is Seen Operating a Portable Bundle Topper, Whose Knife Blade It Runs at 60 Strokes a Minute. In Front of the Topper Is an Arrangement of Levers for Converting the Topper into a Pump Jack

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¶Any bona-fide Swiss manufacturer may belong to a new syndicate for Swiss exportation. Formed to increase Swiss exports, the syndicate intends to make all goods of Swiss origin with the trademark "S. P. E. S."

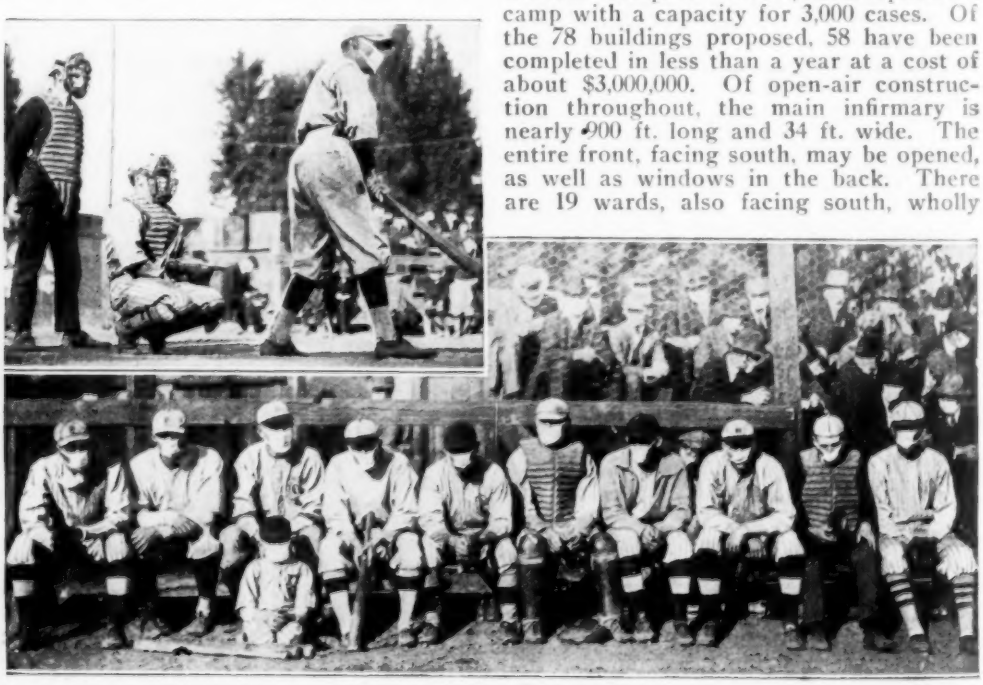
Army General Hospital No. 21 Is the Official Designation for This Big Recuperation Camp at Denver, Colorado Is All of Open-Air Construction, Particularly for the Treatment of Pulmonary Troubles

"FLU" MASKS ADORN PLAYERS AND FANS AT BALL GAME

Late in January last, when the influenza epidemic was rampant in southern California, masks were worn by all the players and spectators at a baseball game held at Pasadena. This may or may not have been the first and only time, as claimed, that such an event has occurred in an American city. The fact remains, however, that for 11 long innings the players indulged in their usual repartee, the umpire shouted his decisions, and the rooters yelled and groaned with perfect form through gauze. And not once, it is said, in all that time was a mask removed—which is not singular when it is made known that blue-coated guardians of civic peace were at hand to arrest and nominate for $50 fines any who might for a moment be guilty of infringing the law.

OPEN-AIR RECUPERATION CAMP ACCOMMODATES THOUSANDS

Colorado being the approved location for natural treatment of lung troubles, Denver was selected as the site for Army General Hospital No. 21, a recuperation camp with a capacity for 3,000 cases. Of the 78 buildings proposed, 58 have been completed in less than a year at a cost of about $3,000,000. Of open-air construction throughout, the main infirmary is nearly 900 ft. long and 34 ft. wide. The entire front, facing south, may be opened, as well as windows in the back. There are 19 wards, also facing south, wholly



Batter, Catcher, and Umpire, at the Top, and One Team and Some of the Fans, Below, are Shown as They Appeared at a Pasadena Baseball Game during the Influenza Epidemic in California

Started May 4, 1918, by the First of This Year 58 of the Proposed 78 Buildings had been Completed. The Camp The Building in the Center Is the Main Infirmary, 900 Feet Long and 34 Feet Wide

open at the front except for fly screens and canvas shades which the patient can adjust from his bed. The wards are unheated, but each patient has a steam-heated, glass-inclosed lounging room. About a thousand soldiers, including some gas victims from overseas, have already been cared for. The camp is expected to handle all the pulmonary cases of the army and navy.

COLORING GLASS BY X-RAYS SUGGESTS NEW ART

A novel method of coloring glass and similar substances, such as porcelain, quartz, and some precious and semiprecious stones, is a recent development in this field. Noting the gradual coloring properties of sunlight on common glass, the experimenter was able to report the production of more striking results by the employment of an ordinary quartz-tube mercury-vapor lamp, or X-ray tube. A purely chemical change is claimed, varying with the intensity of the light applied. The reported discovery is almost certain to have commercial value.

SHIPS MUST NOW BE EQUIPPED WITH LINE-THROWING GUNS

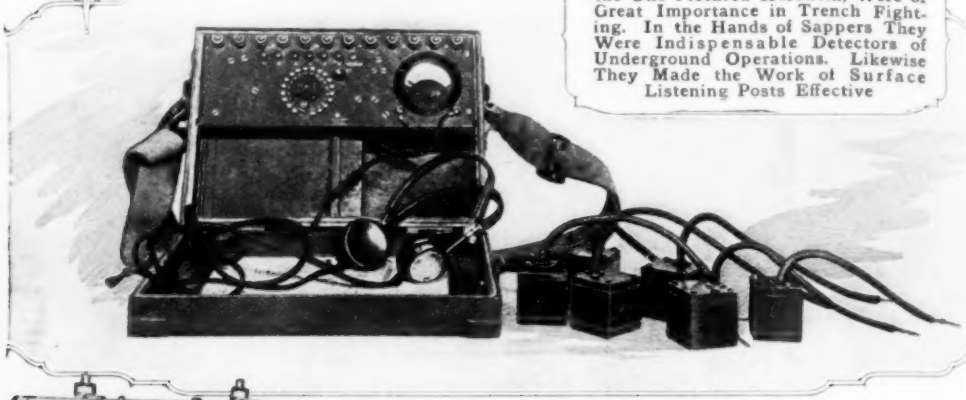
Line-carrying projectiles and guns, or other approved mechanisms for throwing them, are now a compulsory part of the equipment of ocean-going steam vessels, at least three such outfits being specified for each vessel, the only exception being ships of less than 150 tons gross. This rule became a law February 20, by action of the Steamboat-Inspection Service, under whose jurisdiction all ocean vessels navigate. The regulation which it supersedes applied only to those ships which carried passengers.

FORGE INVENTED BY SHIPYARD FOREMAN PROVES ITS WORTH

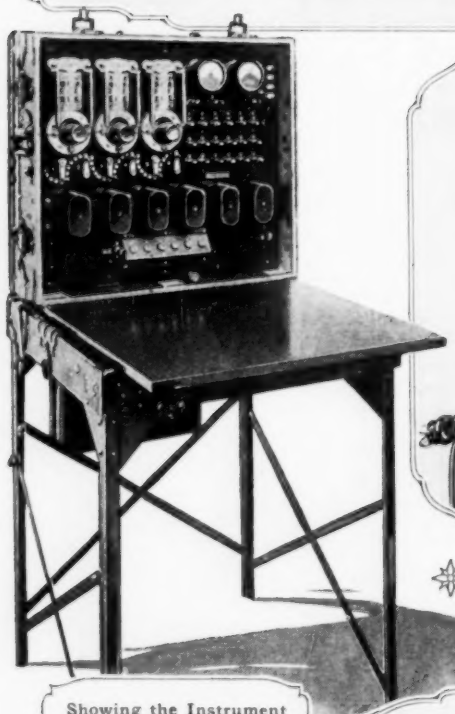
Because operating a fan blower had caused him to suffer from pains in his shoulder, while working as a heater boy a few years ago, a shipyard foreman has invented and patented a rivet heater that tests have shown to be far superior to any now in use. Compressed air is used by means of a diffusing nozzle, thence going through a cone with a number of small holes. The air is subject to control of the cone. An added advantage is a self-feeder for the coke which acts as a gas consumer at the same time, and has proved so successful that the forge may be used between decks without the fumes of gas being felt.

Forge and Automatic Coke Feeder Invented by a Shipyard Foreman

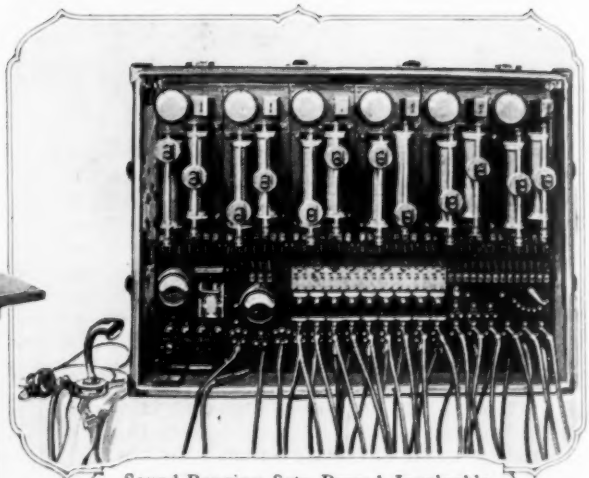
CLOSE-UP VIEWS OF RANGE-FINDING SETS



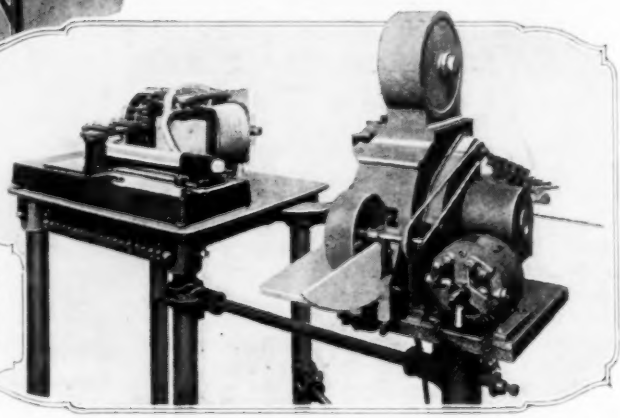
Portable Microphone Sets, Such as the One Pictured Herewith, Were of Great Importance in Trench Fighting. In the Hands of Sappers They Were Indispensable Detectors of Underground Operations. Likewise They Made the Work of Surface Listening Posts Effective



Showing the Instrument Board of a Flash-Ranging Apparatus Which, Used in Conjunction with Telescopes, Enabled Observers to Determine the Positions of Enemy Guns



Sound-Ranging Sets Proved Invaluable for Quickly Discovering the Relative Positions of Enemy Batteries. The Switchboard, Forming a Vital Part of Such Equipment, is Here Shown. It is Reported That One "Listening Section" Located 117 German Guns in 24 Hours



At the Side are Shown the Recording Instrument, Galvanometer, and Tuning-Fork Timing Device Used with the American Sound-Ranging Outfit, Another Part of Which is Illustrated by the Photograph Reproduced Above at the Right

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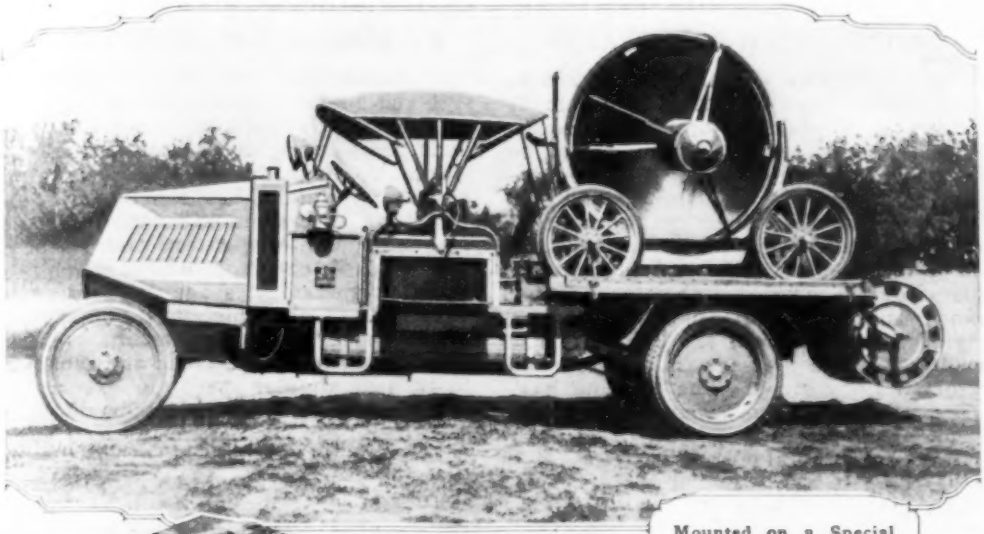
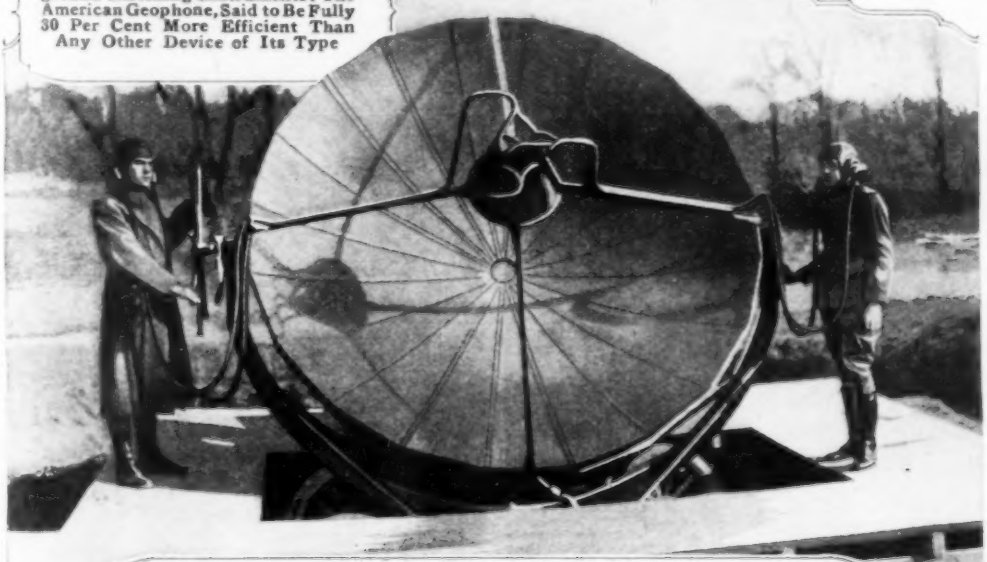
THAT PLAYED BIG PART IN WINNING WAR



Mounted on a Special Military Truck for Quick Transportation: A Portable Combined Sound Detector and Searchlight Used in the Latter Months of the War for Discovering the Approach, and Subsequently the Positions and Courses, of Enemy Aeroplanes

Another of the Effective Underground-Listening Instruments: The American Geophone, Said to Be Fully 30 Per Cent More Efficient Than Any Other Device of Its Type



An American Anti-Aircraft Listening Post near the Fighting Lines: The Big Sound Receiver is So Mounted That It may be Turned Quickly to Any Point of the Compass, and Tilted at Any Desired Angle. Also, It will be Observed, the Device is Carried on Wheels

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BALCONIED ARCADE FEATURE OF CONCRETE SKYSCRAPER

An arcade with a total length of 238 ft., and divided into two stories by a balcony extending all the way around it, is perhaps the most interesting feature of an unusual store-and-office building now being completed in St. Louis, and declared to be the tallest reinforced-concrete structure ever built. Marble, terra cotta, bronze, old oak, and much plate glass line the corridor of the arcade whose motif is a modified English Gothic, a style used throughout the building. The ceiling of the passage is vaulted and groined Caen stone. The building has 17 stories above the pavement and two below, and measures 134 ft. 6 in. by 116 ft. Of its total cost of nearly $4,000,000, the foundation alone absorbed $400,000, because of the necessity for sinking 38 reinforced-concrete caissons through a stratum of quicksand to reach bedrock. Concrete floors, of rib construction for lightness, were molded with collapsible wood forms. A subway station for suburban railway connection is located in the sub-basement.

PHOTOS BY W. C. PERSONS

The 238-Foot Arcade with Its Vaulted Ceiling and Full-Length Balcony Pictured at the Right, the Entrance being Seen at the Left, Is the Principal Unusual Feature of St. Louis' New Store-and-Office Building. This Fine Structure, of a Modified English Gothic Type, is Declared to be the Tallest Ever Built of Reinforced Concrete, Having 17 Stories above the Street Level and Two Below

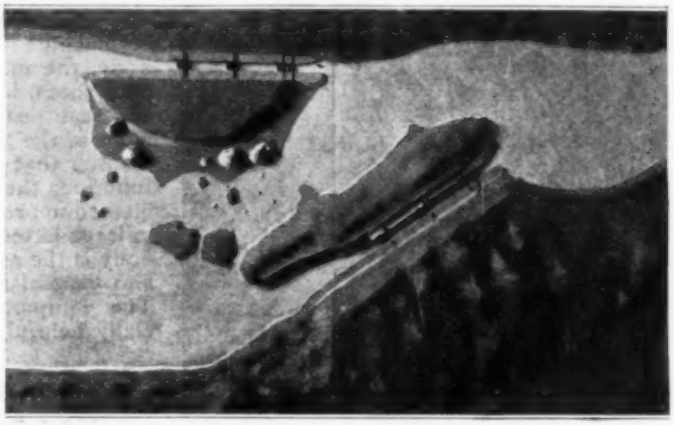
CLOCKWORK FRICTION REDUCED BY USE OF MAGNETIC GEARS

Announcement was made recently before the French Academy of Sciences of the apparently successful use of magnetic gears for reducing friction in clockwork. A magnetic clock, driven by an electric pendulum, has functioned regularly for several months. Briefly, the magnetic gear in question consists of a wheel, on the circumference of which two equal magnetic poles are disposed equidistantly, and alternately north and south. With wheels of this character, magnetic trains of gear can be made and mounted to turn at angular speeds in fixed ratio. They behave as ordinary ones having flexible teeth. In this manner a small magnetic mechanism can be constructed in which the friction will be less than is usual in ordinary instruments.

¶An automobile highway across Canada from coast to coast, first proposed by a club of car owners in Victoria, B. C., is receiving the support of cities along its route. The city council of Regina, Sask., has recently indorsed it.

MODEL OF COLUMBIA RIVER AIDS PLEA FOR LOCKS

A "silent argument" which made a substantial impression on the Oregon legislature was used by the advocates of a new system of locks in the Columbia River to prove the merit of their cause. A relief model of the Cascades of that mighty stream was constructed to show that the present locks, on the Oregon side, are hampered in their usefulness by the excessive swiftness of the current at their approaches. Engineers now propose to construct a similar set of locks on the Washington side of the river, which will greatly facilitate navigation to the interior. The model displayed to the legislature included both existing and proposed locks and every detail of the big, unruly waterway at that point, and proved more comprehensible than a view of the river itself.



Relief Model of the Columbia River Cascades, Presented before the Oregon State Legislature as an Argument for New Locks: The Lower Locks, Installed Years Ago and in Constant Use, are Hampered by Swift Water. The Proposed Locks, on the Washington Side, Are the Upper Ones in the Model

EQUIPMENT STANDARDIZATION UNWISE, SAY RAILROADS

Standardization is an attractive project in any field of applied mechanics. The proposal of the railroad administration to adopt standardized equipment for all railroads under its control, however, has elicited expert opinion that such a course would not be good practice. The efficient performance of a locomotive, for example, is governed by such factors as the nature of fuel available, weight of rails, and strength of bridges, length of freight-passing sidings and turntables, and depth of roundhouses. Even if these elements were, in their turn, to be standardized, the unavoidable natural features of alinement, and grade conditions, differing with each railroad, must be considered in the selection of locomotives for the most efficient and economical transportation of goods over that road. Such consideration would be hampered by confining selection to arbitrary types and models.

¶The French department of industrial reconstruction has replaced the department of munitions. The minister in charge will distribute among French industries the orders placed by other government departments.

BIG LOADS OF COTTON PROVE VALUE OF GOOD ROADS

Southern cotton growers have been quick to realize the commercial value of good roads. Money invested in scientific road building is well spent, as witness the illustration, where a single team is hauling 12 bales, about 6,000 lb., to market. Under former conditions, with mud hub-deep the year around, the same team could haul but one bale, and that only half as fast.

The Way the Southern Grower Hauls Cotton in These Days of Good Roads: In the Good Old Days One Bale Was the Limit

CENSORS TRY CHEMICAL TEST ON SUSPICIOUS LETTERS

Letters are not always what they seem, especially in times of international disturbance. Secret and "sympathetic" inks

Suspicious-Looking Letters That might Bear Secret Messages Written with Sympathetic Inks are Given a Chemical Test in the Base-Censor's Office of the American Service of Supply in Paris

are as old as chemistry; but there is always a way to discover them. In the base-censor's office in the American Service of Supply, at Paris, all letters that look at all suspicious to the experienced censorial eye are sent to the thoroughly equipped chemical room for a series of searching tests.

¶ Photographs of the graves of American soldiers in France are being taken at the rate of 7,000 a month, and mailed to the nearest relative of each soldier in a cardboard frame with data from his record.

TRAVELING MOTOR-TRUCK SHOW USED FOR SALES PROMOTION

For advertising and sales-promotion purposes, a truck-distributing concern with territory in three eastern states is operating a "traveling motor-truck show." A machine with a large, white, paneled body, the interior of which is fitted as a showroom, is being placed at the disposal of local dealers. The various working parts of the model are exhibited in such a manner that their points of merit and the functions they perform may be clearly explained to prospective purchasers. Printed in large letters on the exterior sides of the body is the essence of the sales argument, and general information about the truck. The equipment is expected to be especially helpful to new dealers.

BIG ROAD-MAKING CONVEYOR HAS CAR TRACK ON TOP

Little dump cars running on a track mounted on heavy iron wheels form one part of a belt conveyor, 60 ft. long, used in road work along the William Penn Highway. The cars, placed at any convenient point on the horizontal, or track, portion of the big machine, are filled by laborers from the piles of material alongside and then rolled to the inclined part of the conveyor. Here their contents are dumped onto the belt, traveling 500 ft. a minute, conveyed to the end of the incline, and discharged into the scoop of the concrete mixer. The conveyor handles 100 cu. ft. of material a minute and because of its wheels readily shifts its location.

The Horizontal Portion of This Big Belt Conveyor Is a Track, on Which Run Little Dump Cars. They are Filled from the Piles of Material Alongside, and Then Rolled to the Inclined Belt, on Which They Dump Their Contents for Final Discharge over the Top into the Scoop of the Concrete Mixer

Part of a Government Flock of Sheep at the Close of a Season's Pasturing: These Animals Showed a Considerably Greater Increase in Weight Than Others That Grazed Open Ranges

INCREASING THE EFFICIENCY OF GRAZING LANDS

By ROBERT H. MOULTON

PROBABLY only a small minority of the sheepmen in this country know that by using a system of fenced pastures, instead of the present open-range herding, they can increase the size of their lambs from five to ten pounds in a single season, make the wool clip from one to three pounds heavier, reduce the acreage now required one-third, and decrease the present loss and the cost of handling four-fifths. These figures represent the records of coöperative experiments carried on for a number of years by the U. S. Forest Service and the Bureau of Plant Industry.

For the experiments, an area of typical sheep range, 2,500 acres in extent, on the Wallowa National Forest in northwestern Oregon, was selected and inclosed by a combination woven-wire and barbed-wire fence, so substantially built that it is practically coyote-proof. This fence consists of a four-point barbed-wire fence on the surface; 3 in. above this a 42-in. woven-wire fence with 4-in. triangular mesh; 6 in. above the woven wire a barbed wire; 8 in. higher a second barbed wire; the posts being set 2½ ft. in the ground and spaced one rod apart. Within this inclosure a normal flock of sheep was turned loose. During three seasons the fence was patrolled each morning between 4 and 10 o'clock by a hunter with hounds, and although, at first, bears, which easily broke the fence, were numerous, the end of the second season had so reduced them that they no longer constituted a menace. As to coyotes, they are still present, but so far as could be ascertained, not one succeeded in getting inside the fence except when the snow lay deep in winter, and they caused no loss whatever.

Hunter and Dog Patrolling the Fence, Which during the First Season was Occasionally Broken by Bears. Coyotes, Except in Winter When Aided by Deep Snow, could Not Pass

To compare the number of sheep that the range in question would support under the two systems, observations were made to ascertain the grazing capacity of approximately 30,000 acres surrounding the experimental area. During the first year the herded flocks used from one and a half to two times as much range per head as the pastured sheep, the second season showing a similar percentage.

The lambs were weighed and marked at the time they were turned loose in the inclosed pasture, and weighed again when taken out at the close of the summer season. The records show that the pastured lambs gained on an average of

twenty pounds during the first season of approximately 90 days, while lambs of the same grade handled under herding on the range averaged only 15 pounds' gain during the same period. This difference was increased from 7 to 10 pounds the succeeding seasons. The greatest loss under pasture for the four seasons never reached one per cent, and went as low as one-fifth of one per cent, while the loss from herded flocks near by varied from one to four per cent.

As to the wool growth, no definite figures have yet been arrived at, but the owner of the lambs raised in the pasture during the first season stated that, when they were sheared the following year, the clip was at least one pound heavier than that of any other lambs of the same age and breeding he had ever sheared.

The comparative cost of handling under the two systems depends somewhat upon the locality. It has been determined, however, that one man familiar with handling under pasture could care for four pastures similar to the one in Oregon, which would mean the care of from 8,000 to 10,000 sheep. To handle the same number of sheep under open-range herding in the same locality requires the attention of four men working as herders and two men tending camp. This, of course, does not take into account the cost of building and maintaining the fence. It is figured, however, that a fence should pay for itself in not to exceed five years, and that, with a small cost for maintenance, it should last 15 years. The fence here referred to has not cost to exceed $5 per mile in upkeep in any one year.

In any event, the main advantage of raising sheep in this new manner would lie in the protection it affords the flocks. For under pasture the sheep are free and quiet at all times, they grow larger and can be kept in better condition than when herded in the open; and it is a recognized fact that the growth of wool and its quality is in a large measure dependent on the health of the animals.

SCREWDRIVING MACHINE MOUNTED ON WHEELS

Automatic screwdriving machines are of necessity quite cumbersome, having to carry a driving motor and a magazine for the screws, and requiring a firm mounting. For handling heavy and awkward work which must be finished at the bench, a machine manufacturer has designed an automatic screwdriving equipment pivoted on a vertical column which is carried on a base with ball-bearing, flanged wheels. The spindle bearing, driving mechanism, and screw magazine move laterally upon an I-beam, which swings freely on its pivots and may be raised or lowered. The whole machine is moved on its wheels by turning a hand crank.

The Wheels on Which This Screwdriving Machine is Mounted are Turned by the Crank at the End of the Beam, at the Right, Moving It on Its Rails from Bench to Bench

¶ Naples is assured the greatest dry dock in the Mediterranean by the recent signing of all necessary government bills.

CALIFORNIA'S CLAY MOUNTAIN BUILDS SHIPS AND CITIES

Southern California, ambitious to gain fame for something more substantial than a prize climate, now calls special attention to its tremendous deposits of a certain valuable clays. There is, indeed, a veritable mountain of this material 78 miles from Los Angeles. Four government concrete ships are being built, using it as light aggregate in the mixture instead of sand and rock. The district recently sent out 140 carloads of hollow tile, made from the same substance, for a government hospital in Arizona. Pressed brick, paving brick, fire brick, hollow building block, roofing tile, architectural terra cotta, sewer tile, chemical stoneware, underground electrical conduits, and crockery clay are a few of the specific products yielded by the contents of this warehouse of nature. There are 12 varieties of clay in the deposit.

Buffalo's Memorial Arch in Honor of the Returning Heroes of the 27th Division: It is to be Dedicated on Memorial Day. The Arch is Located in the Down-Town District, and will Remain Standing for Two Years. Besides Its Memorial Inscriptions It will Carry the Names of Those Who Made the Final Sacrifice

MEMORIAL ARCH IN BUFFALO TO HONOR FIGHTING MEN

When the fighting men of the 27th division return from foreign battle fields to their homes at Buffalo, N. Y., they will march under a magnificent memorial arch in the center of the down-town section, where 70,000 people pass every day. It will be located just opposite the Soldiers' Monument in Lafayette Square, and will be constructed to stand for two years, according to present plans. The arch is to be finished in time for formal dedication on Memorial Day, and it is estimated that the cost will be about $25,000. Inscribed at the top are the names of French battle fields and the words, "Erected to Commemorate the Homecoming of the Victorious Army and Navy of These United States of America, and in Memory of Those Who have Made the Supreme Sacrifice for the Triumph of the Free Peoples of the World and for the Promise of an Enduring Peace—1919."

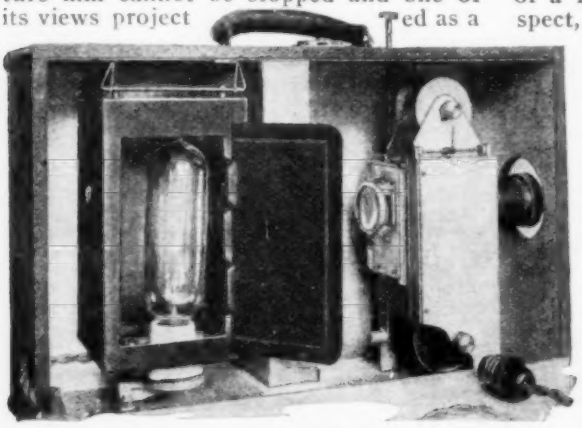
¶ Discovery of a process for making cotton substitute from seaweed is claimed by a Japanese fiber laboratory.

ROTATING SCRAPER FOR IRON REMOVES RUST AND PAINT

Old rust and paint from such iron structures as ships, bridges, and tanks may be quickly removed with a revolving scraper, run by electric motor. The tool will clean badly incrusted surfaces at the rate of 30 seconds to the square foot, or even faster. The ½-hp. motor, either placed on a small truck or suspended at a convenient point, turns a flexible shaft 4,000 r. p. m. The tool consists of a triangular hub, at each corner of which four hammer bars are pivoted, held radially in action by centrifugal force. These bars, at full speed, strike 48,000 glancing blows a minute.

LANTERN USES "SLIDES" MADE ON MOTION-PICTURE FILM

With the usual apparatus a motion-picture film cannot be stopped and one of its views projected as a still picture, because the heat of the concentrated rays would instantly destroy the film. Nevertheless, the fine quality of the standard motion-picture stock, despite its small surface, gives even better projection results than the glass lantern slide, and a new form of portable stereopticon takes advantage of that fact. The reels of the machine hold 50 ft. of film, or 800 pictures. Depressing a push button on top of the case advances the film just one picture or "frame." A 300-watt incandescent lamp throws a picture of great brilliancy on a screen up to 10 ft. wide, at any distance up to 200 ft., and because of the system of ventilation a film may remain in focus indefinitely without perceptible heating. Films are light and easily changed, and in both convenience and reliability have many advantages over glass. The machine weighs but 12 pounds.



This Suitcase-Size Stereopticon Projects Views Made on Standard Motion-Picture Film Stock Instead of Glass Plates. Pictures are Changed by Pressing the Button on Top, but may be Held Indefinitely without Heating

NEW BOILER HEADS MEASURE MORE THAN FIFTEEN FEET

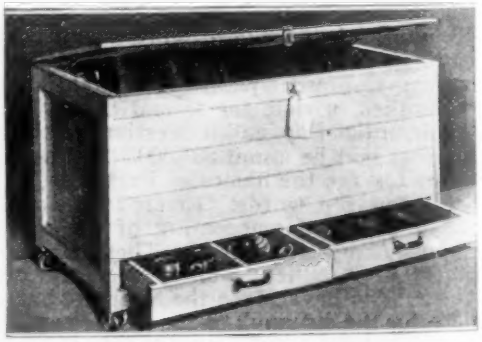
The production of a marine tubular-boiler head 13 ft. in diameter, recorded in the February, 1919, number of Popular Mechanics, has been eclipsed in the same Pennsylvania steel plant. A pair of heads were recently completed which measured 16 ft. 6½ in. in diameter as sheared, and over 15 ft. after flanging. Each head was 1⅛ in. thick and made from a single sheet of steel, and in that respect the performance is announced as a world's record.

ENTIRE STEEL-TRUSS FACTORY SENT ON SHIP TO ITALY

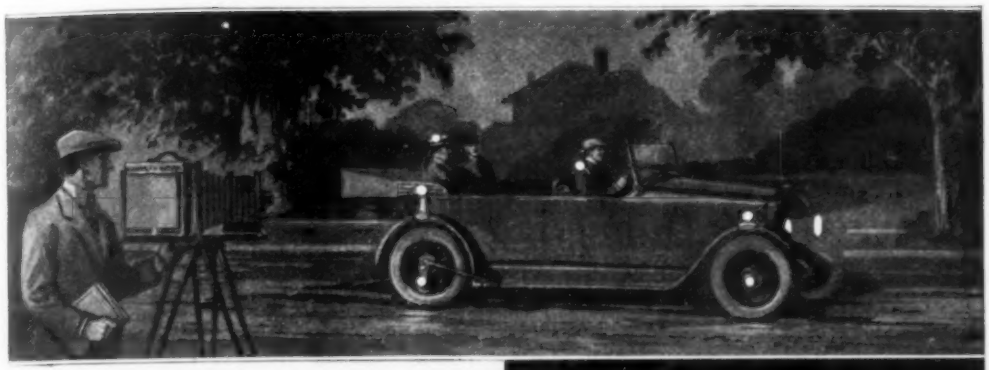
Because an Italian engineer approved of a factory which he came here to inspect, as well as the expanded-steel trusses which constitute its product, an exact duplicate of the whole plant is being shipped all the way to Italy from the outskirts of Chicago. The Italian factory, when the shipload of 340,000 lb. of machinery has been assembled at Savona, will start making steel transmission towers for the high-tension electric lines whose development has a large part in the country's reconstruction plans. The trusses manufactured by the plant are made from steel I-beams peculiarly cut on a large rotary shear and then expanded in a machine specially designed to give them truss form with the necessary strength. Steel interests controlled by the Italian government have advanced $400,000 that the transplanted factory may take firm root in foreign soil.

CHEST FOR EACH CAR OWNER IN REPAIR STATION

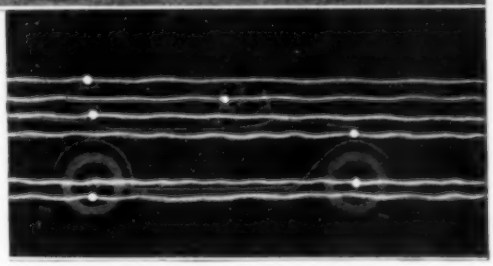
Each automobile owner who brings his car for repair into the service station of a factory branch in Indianapolis, Ind., is provided with a chest in which the cushions and other loose items are deposited. At the bottom are two drawers for the smaller parts. The chest, which moves about on casters, may be padlocked, and is identified with its particular car as long as the latter remains in the shop. This avoids loss or misplacement of parts, and relieves the attendants of responsibility.



One of These Chests Is at the Service of Every Auto Owner Whose Car is Undergoing Repair in an Indianapolis Factory Branch. It Keeps the Loose Parts Together and Prevents Loss



Small Electric Lights are Mounted on Hubs, Fenders, Body, and Other Points of This Car: When It is Driven Past an Open Camera at Night, the Plate Records the Relative Movement of One Part to Another



This Is the Kind of Record That Appears on the Photograph. Each Wave in the Horizontal White Lines Represents a Vertical Movement of Some Part of the Car

STUDY MOTION OF CAR PARTS ON PHOTOGRAPHIC RECORD

The relative movements of one part of an automobile to another—of the body to the wheels, the cushions to the body, the wheels to the road—are potent factors in determining economy and comfort. A large manufacturer of luxurious cars has protected by patents a system of making photographic records of car performance in this respect. Small electric lamps are attached to wheels, fenders, body, and any other points desired. The car is then driven past a camera whose lens is left open, the test being made at night. Each lamp is recorded as a streak across the photographic plate, the deviations from a straight line indicating the relative vertical movement of the part on which the lamp was mounted at any instant. Lamps of different brilliancies are used to aid identification on the photograph.

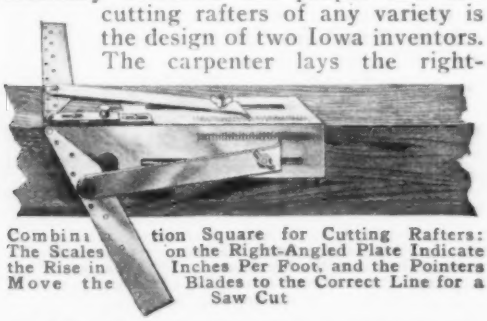
STEAM-TURBINE WRECK CAUSED BY CENTRIFUGAL FORCE

How violent is the disruptive power that lies in centrifugal force was demonstrated to the attendants of a Colorado electric central station, a short time ago, when a steam turbine used to drive a blower fan blew up with all the effect of a burst of shrapnel. The centrifugal governor failed to work; the speed of the turbine rapidly accelerated until the radial pull became too great for even steel to stand, and the whirling metal flew to pieces. Severed portions of the turbine passed through the fan screen with such velocity that the fan, used for supplying forced draft to the boilers, was wrecked, and the heavy standard on the other side broken. The only man injured, an electrician, lost his great toe when his foot was struck by a bulletlike piece of metal which catapulted out of the dizzy machine. Other attendants escaped by narrow margins.

All That was Left of a Steam Turbine After Its Governor Failed and Centrifugal Force Got in Its Work: Pieces of Flying Metal Wrecked the Fan Screen, as Shown at the Left, and Broke the Heavy Bearing Standard

SQUARE FOR MARKING RAFTERS SAVES CARPENTER TROUBLE

A combination square which automatically indicates the proper line for cutting rafters of any variety is the design of two Iowa inventors. The carpenter lays the right-angled plate of the square on one corner of the rafter. Two blades, pivoted at one end of the plate, lie across the top and side of the rafter, respectively. Graduated scales on the two sides of the plate indicate the number of inches of rise per foot of running rafter, and pointers on these scales are connected to the blades. By setting the pointers at the proper figures for any particular rafter, the blades so place themselves that a mark along their edges guides the saw for a cut at the correct angle.



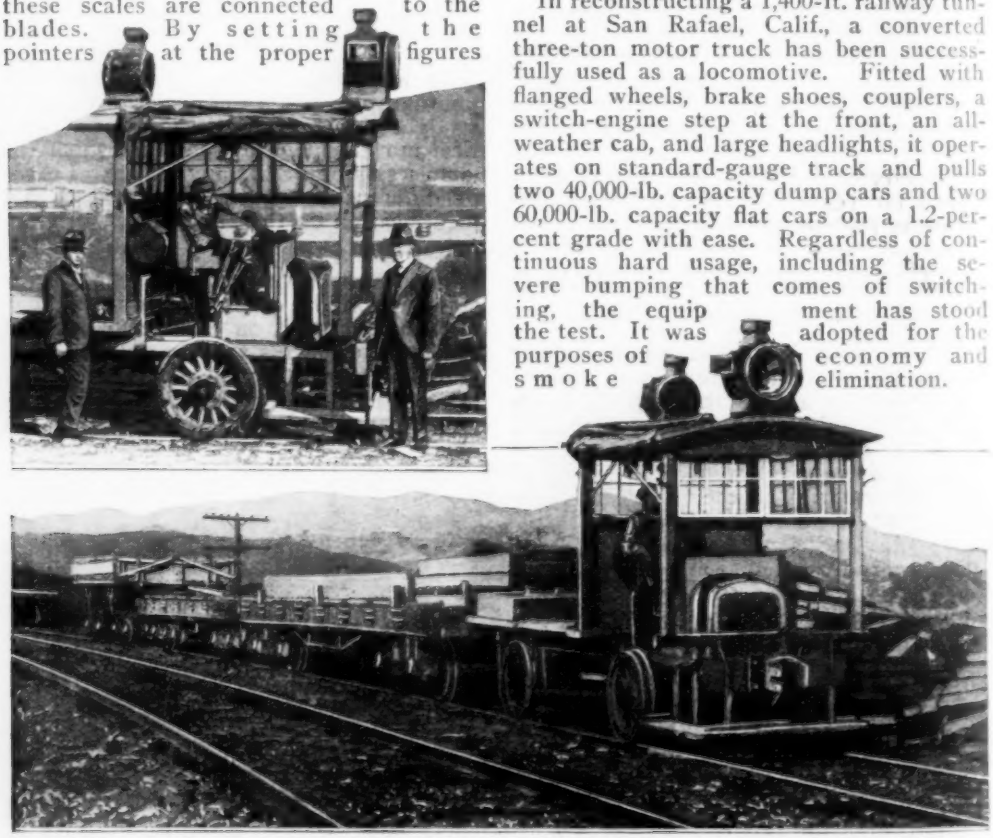
Combination Square for Cutting Rafters: The Scales on the Right-Angled Plate Indicate the Rise in Inches Per Foot, and the Pointers Move the Blades to the Correct Line for a Saw Cut

HASTEN SEASONING OF WILLOW FOR ARTIFICIAL LIMBS

Willow used for making artificial limbs must be carefully seasoned, and the process formerly required from three to five years. By exact determination of the correct temperature and humidity needed for the most satisfactory results, and a study of the circulation in the kiln used for drying, the Forest Products Laboratory has been able to accomplish complete seasoning in 60 to 70 days. Preparation of the willow in proper form for drying also has considerable influence on the time required.

CONVERTED MOTOR TRUCK USED AS RAILWAY LOCOMOTIVE

In reconstructing a 1,400-ft. railway tunnel at San Rafael, Calif., a converted three-ton motor truck has been successfully used as a locomotive. Fitted with flanged wheels, brake shoes, couplers, a switch-engine step at the front, an all-weather cab, and large headlights, it operates on standard-gauge track and pulls two 40,000-lb. capacity dump cars and two 60,000-lb. capacity flat cars on a 1.2-percent grade with ease. Regardless of continuous hard usage, including the severe bumping that comes of switching, the equipment has stood the test. It was adopted for the purposes of economy and smoke elimination.



Used in Connection with Railway-Tunnel Construction in the West, This Converted Motor-Truck Locomotive Pulls Four Standard-Gauge Cars with Ease. At the Top Is a Close View of the Cab

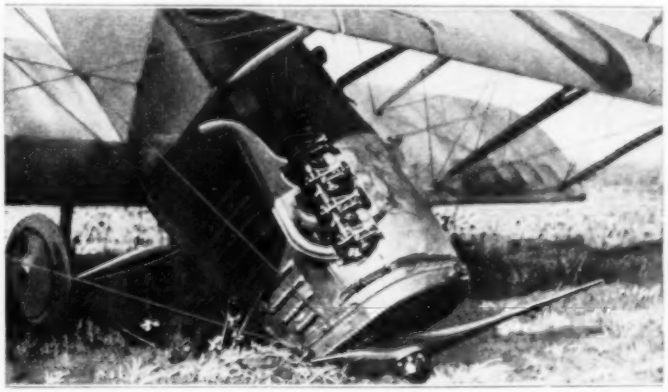
WHY AIRPLANES FALL

By ROGERS D. RUSK

Signal Corps Meteorologist

THE biggest problem today in aviation is not how to make airplanes fly, but how to keep them from falling. One of our crack airmen once remarked with a twinkle in his eye: "Flying is perfectly safe—that is, unless you happen to fall."

In one illustration is shown a ship which buried its nose in the ground, and from which the flier barely escaped with his life. The propeller snapped off like a toothpick, and the plane went into a downward spin, from which the pilot tried to extricate himself, but was unable to do so until just before he struck the ground. If he had had a few hundred feet more to fall the accident would no doubt have been avoided. This is a good illustration of the well-known fact that the nearer the earth one flies, although he may feel safe, the less chance he has of saving himself in case of accident.

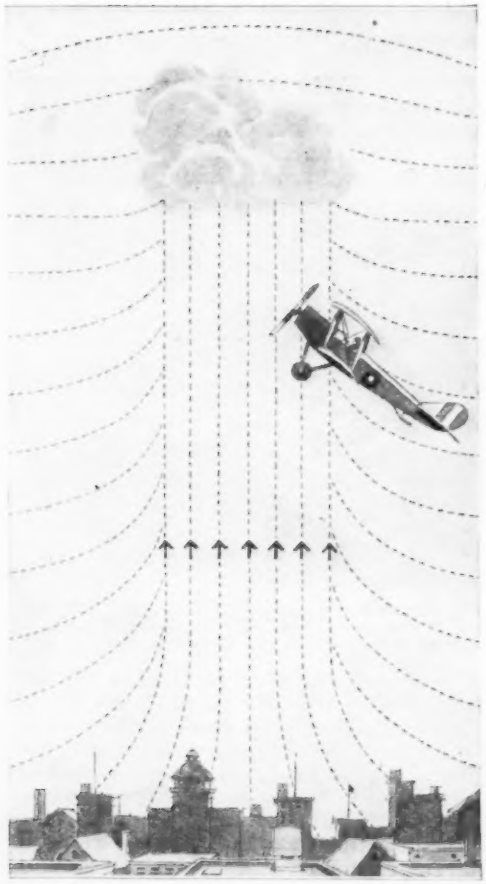


An Aeroplane can Land Anywhere Any Time, but Not Always in Complete Accordance with the Pilot's Wishes. This Shows How One Machine Concluded Flight after the Propeller had Broken in Mid-Air

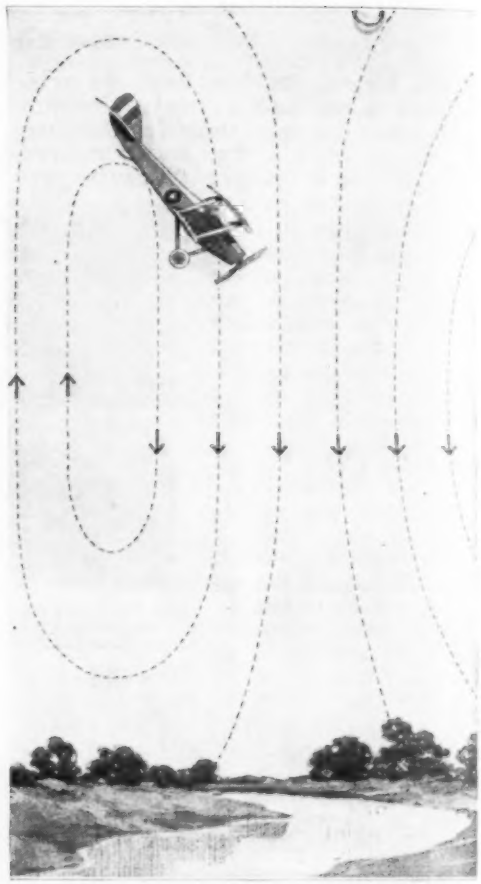
Contrary to common opinion, airplanes seldom fall (except in battle) from some failure in the mechanism, such as a wing coming off, or the engine stopping. With the Liberty motor, and other similar high-powered engines of today, more power and speed can actually be developed than the airplane can stand, due to its lightness of construction. Speeds of 100 to 150 miles an hour are common, and it may be said that, barring accidents, an airplane never falls so long as its speed is maintained. If it loses speed, or if the engine stops entirely, the airman can generally glide safely to the ground. The slow Curtiss plane, with a speed of 60 miles per hour, can land in most any field, but the speedier planes, such as the De Haviland, which is twice as fast as the Curtiss, take a much greater space in which to light. Such fields are now being located along airplane routes all over the country. It is the accident, however, which the pilot fears and which every effort is being made to eliminate. The business man of tomorrow who makes a hurried trip from New York to Chicago does not want to take a very big chance of being suddenly and unceremoniously dropped in some farmer's back yard along the way.

The Picture Presented Here Illustrates an Unfortunate Landing Similar in Effect to That Indicated Above and Caused by Running into an "Air" Hole

Army investigations have shown tha the majority of accidents, except from collisions in mid-air, are due to the flier losing control of his plane, or to irregularities in the air itself which have caused the accident, or which have caused him to lose control. It comes as a distinct surprise to some of us that instead of the upper air being in a uniform state of rest or motion, it is really in a constant turbulence, which is anything but uniform, and we hear such things spoken of as "bumps" and "holes" in the air, eddies and whirls, and cascades and foun-



Illustrating What is Meant by a "Bump" in the Air: An Up-Going Current Caused by the Uneven Heating of the Earth's Surface, Which "Bumps" a Plane in the Manner Indicated



The So-Called "Hole" in the Air Is a Downward Current Occasionally Encountered at Moderate Elevations above Water and Wooded Territories. If Pronounced, It may Cause Trouble

tains. It seems that just as a motorist may run off the road into a ditch, the airman may run into a "hole" in the air—more so as the so-called hole in the air is invisible. It is such irregularities in the atmosphere as these, that the government and the U. S. Weather Bureau are studying and attempting to map every day, just as is done with the weather at the earth's surface.

The term "hole," in the air is very misleading, as there can be no such thing as a hole in the air. There may be points of greater or less density, but the variation is usually so slight as to be negligible, except in the extreme case of storms such as hurricanes, in the center of which is a partial vacuum. What is commonly called a hole in the air is really a downward current of air which causes the airman to drop unexpectedly. Such currents are frequently found near or over bodies of water, or wooded regions, and may extend as high, at times, as a mile in the air. Another illustration shows a plane in which the pilot landed in a startling and embarrassing manner a short way from the Mississippi River. While flying near the ground he felt himself suddenly carried down by an air current, and he was unable to recover in time to rise again.

Bumps in the air are just the opposite of holes, and are due to upward currents of air which are always more or less noticeable on bright sunny days, especially in summer, due to uneven heating of the earth's surface. Such currents are generally found over open land, plowed ground, and even roads. It is interesting to note that these up-currents may usually be detected by the big billowy cumulus clouds that form at the upper extremity of a rising current, due to the cooling

and condensation of the moisture in the air. Every such cloud that dots the sky in warm weather indicates a rising current of air and the existence of a bump. The way an airplane is tilted by such a bump is also shown. When this occurs, the pilot must right his ship, and if he does this too quickly an accident may result.

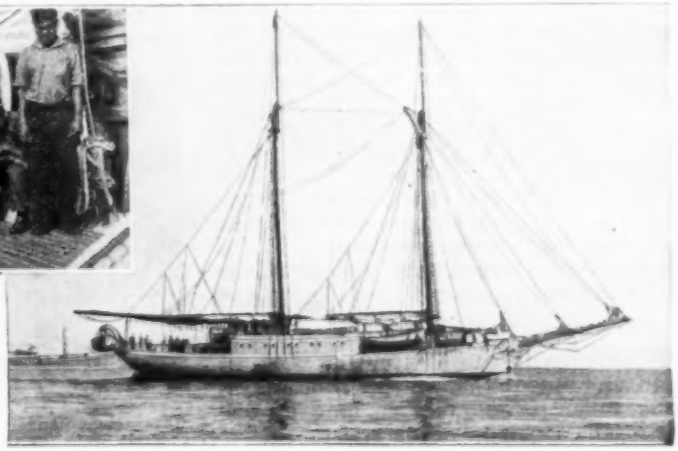
Vertical eddies, and many other peculiar phenomena, frequently occur and are only visible through the motions of the clouds. They may be detected, however, by the use of small balloons set free in the air. Of course these currents are seldom violent except in the case of storms. If such were not the case, flying would be next to impossible. In a thunderstorm the winds rage with almost unbelievable violence, and the unfortunate airman who is caught in one is whirled and battered in all directions, and his ship is frequently torn to pieces. Only a few survivors of such experiences have returned to tell the tale.

MOTORBOATS USED FOR COPRA TRADING UNUSUAL IN DESIGN

Designed especially for trading with the natives of tropical islands, three boats, recently completed in San Francisco, are particularly interesting. They are being used mainly in trading for copra—dried coconut meat from which coconut oil is derived. These vessels, which are combination sail and motor boats, are equipped with specially designed compartments, and, from the variety of articles carried in stock, resemble very much the old country store. This stock is made up of articles much sought after and highly prized by the natives, and, as the boats go from island to island, it is exchanged for copra, which is then taken to a central point and reshipped on ocean trading vessels. The crew brought to San Francisco to man these vessels was a curiosity. It was claimed by the captain in charge that they were cannibals several years ago, and they gave every indication of having been. They lived on meat, boiling large pieces which they tore up with their hands and devoured.

ALARM CLOCK TAKES NEW JOB AS PRIVATE SECRETARY

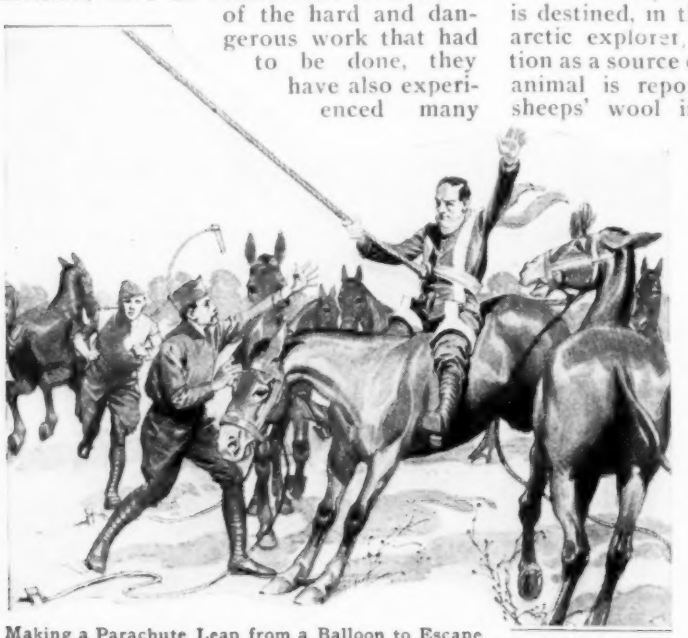
To keep us from forgetting time even for a minute, the makers of alarm clocks now have provided one that either emits a soft buzz to hint an appointment or another dose of medicine, or rings a loud gong to induce wakefulness, after the time-honored manner of such devices. The alarm may be set accurately to the minute because the indicating pointer is located on the bezel, which is turned to set it, making exact adjustment an easy matter. This quality of precision enables the clock to extend the household usefulness of its ancestors by working as a laboratory assistant or business reminder, in which its alarm might be used many times during the course of the day.



Left: The Eight Natives Comprising the Crew, Who were Said to have Been Cannibals a Few Years Ago. The White Men Are the Designer and Builder of the Vessels, and Two Engineers. Right: The "Murua," One of Three Vessels Recently Built for Tropical-Island Trading

OBSERVER LANDS ON MULE IN PARACHUTE JUMP

While men in the army air service, particularly those in the observation-balloon division, have all contributed their share of the hard and dangerous work that had to be done, they have also experienced many amusing incidents. Some of them might not have been so entertaining at the time, but later reflection would show the laughable aspects predominant. A good example is the experience, last fall, of an observer attached to the First Army. He had been up for several hours making notes on enemy infantry operations when he was suddenly attacked by a single-seat combat plane. The balloon crew on the ground immediately began to haul the big gas bag down, but the observer was running no chances and took to his parachute. This drifted well back of the lines and deposited him in the midst of a number of grazing army mules, and right astride one mule. The mule, not taking kindly to the sudden load forced on him, began to rear and plunge, starting quite a commotion among the herd, and the observer was rescued with difficulty from his precarious position.



Making a Parachute Leap from a Balloon to Escape an Attacking Airman, the Observer Alighted Astride a Balky Mule, Grazing with Others Well Back of the Lines

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¶ The Italian institution for the war-disabled announces that it will continue to bring relief to sufferers as long as one war-disabled person needs assistance.

GET WOOL, MILK, AND BEEF FROM NORTHERN MUSK OX

Of a size between the sheep and the ox, yielding the wool of one and the beef of the other, the musk ox of the North is destined, in the opinion of a celebrated arctic explorer, to attract greater attention as a source of supply. The fleece of the animal is reported by experts to equal sheeps' wool in quality, and a government department is now engaged in making careful studies of its comparative usefulness and economy. The animal's habitat on the frozen plains of Greenland and the barren reaches of America's northern latitudes makes it master of a range that cattle cannot penetrate. In its chosen country, therefore, it becomes the sole source of good beef and milk—a virtue perhaps more important to its human neighbors than the excellence of its wool, which is the chief commercial interest. Scientifically the musk ox is related neither to the sheep nor to the ox, but represents a distinct genus by itself. The fur is of a brownish color.

PREPARING FOR THE CAMPERS IN THE NATIONAL FORESTS

Always mindful of the public safety and convenience, the government employs its forest rangers, during part of the winter months, in making trail signs.

Government Rangers Spend Winter Hours Preparing Trail Signs for the Benefit of Summer Tourists

Carefully painted, stamped, and varnished, these boards are later crated and shipped to the rangers, who distribute them throughout the vast national forests. The signs prove themselves very useful, being placed every half mile along the trail, and at points where it crosses a road or stream.

AMERICAN BOMBING PLANE LANDS IN MUDDY FIELD

The seventh Handley Page bombing machine built in this country met with misfortune recently, at an Illinois aviation field when returning, with its six passengers, from a successful expedition to the near-by bombing ground.

This American Handley Page Bombing Plane was Damaged in Landing in Sticky Mud at an Illinois Aviation Field

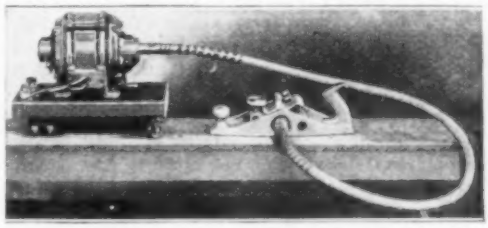
Alighting at high speed on a sticky, muddy field, the landing gear was retarded and the plane "stuck her nose in." No one was injured, although the twisted wreckage had to be cut away from the observer in the forward cockpit. Interest attaches to the machine as it belongs to the first American bombing squadron on this side of the Atlantic.

SNOW IN VACUUM BOTTLES FOR PEOPLE WHO NEVER SEE IT

Those of us who are used to the more or less rigorous winters of the North may think it strange that there are people in the United States who have never seen snow, except possibly on mountain tops at a distance. Conditions such as this exist in southern California in particular. Tourists and mountain-climbing parties have been in the habit of filling their vacuum bottles with snow for the edification of their friends in the lower valleys, where it is quite a novelty. In fact a bottle of snow was recently presented to a high-school physics class for the study of snow crystals.

POWER PLANE LESSENS MANUAL LABOR FOR CARPENTER

As a labor-saving tool for the use of carpenters, an interesting type of elec-



Connected through a Flexible Shaft with a Caster-Mounted Motor, the Plane is Well Adapted for Surfacing Floors

trically operated plane has been introduced of late. The device is equipped with a rotary knife connected through a flexible shaft with a motor. The latter is mounted on a base fitted with casters so that it may be readily moved from point to point. While the plane is said to be suitable for many uses, it is especially adapted for surfacing floors and accomplishing work of similar character.

CHOICE OF AIR-BRUSH TINTS IN MULTIPLE COLOR CUP

In place of the color cup holding a single tint ordinarily used on an artist's air brush, a New York inventor has worked out a system of dividing the cup into a number of cells, each containing a different color. By loosening a screw and turning the cup, any desired cell may be brought into position for use, and any

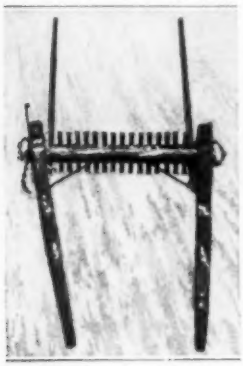
Air Brush with Multiple Color Cup, Allowing the Artist to Change Quickly from One Tint to Another by Loosening a Screw and Turning the Cup

color within the limit of the total number of cells is made quickly available. Tightening the screw locks the color cup in position.

¶ In South Australia the returned soldier is advanced up to $3,000 for purchasing a home. The grant is not made to unmarried men, however, nor to those with a moderate income.

NOVEL DEVICE TO ROUGHEN SNOW-PACKED SIDEWALKS

Following a heavy snowstorm, pedestrian traffic will invariably pack the snow down; it becomes virtually as hard and slippery as ice, and is as difficult to walk on. As a means of combating this evil, the city of Ottawa, Canada, has been using a scratcher to roughen the surface of the ice-coated walks and thus make walking comparatively easy. This scratcher is about 3 ft. wide and consists of steel prongs bolted to a steel cross piece. To give greater scratching surface, the teeth on the prongs are split. This device is horse-drawn and may be operated by one man. Practically the only repair work necessary on it is the sharpening of the teeth.



BOSTON COMMON TO REMAIN A WAR GARDEN

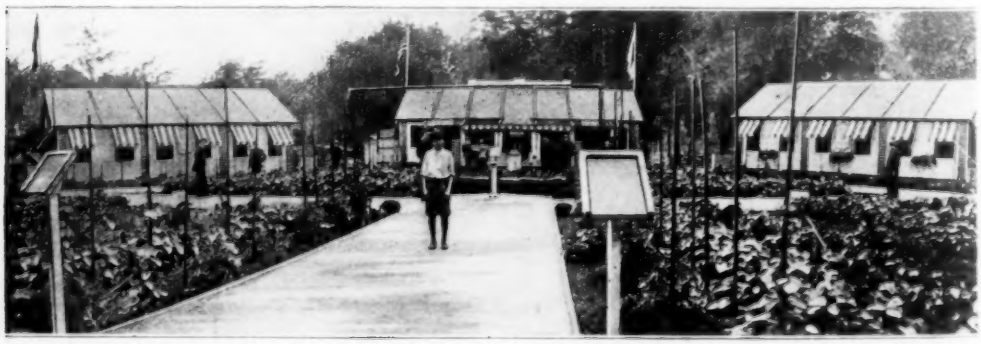
Surprise was general when the authorities voted to devote staid old Boston Common to gardening purposes for the duration of the war. The experiment proved a success, however. The new common not only yielded valuable produce, and gave room for many wooden buildings housing various patriotic enterprises, but it furnished, also, a convincing demonstration, to the passer-by, of the worth of the back-yard garden. And Bostonians were recently startled still more by a decision to retain this innovation permanently. The common has appeared very attractive in its new garb, and it is popularly felt that the nation still needs every available acre of arable ground.

EUROPEAN AERIAL ROUTES IN ACTUAL OPERATION

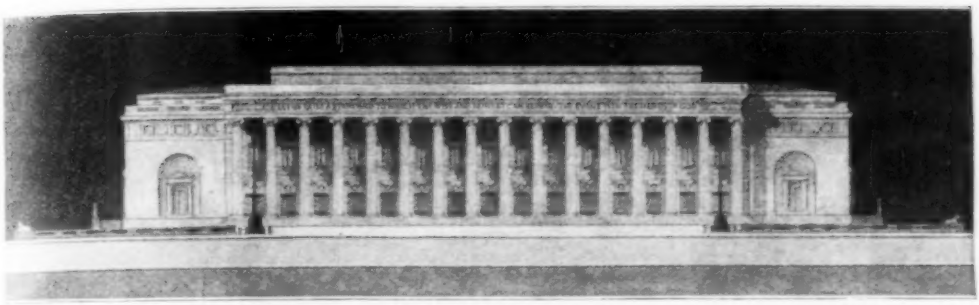
Among the innumerable proposed aerial postal routes throughout the world it is interesting to find a few actually operating. Chief among these are Italian routes between the mainland and Sardinia, and between Rome and Turin; a Danish mail and passenger line from Copenhagen to Skagen; and an Austrian route from Vienna to Lemberg. Not yet operating, but soon to become a fact, is the very important line between Paris, Brussels, and London. An international postal line between Stavanger, Norway, and Aberdeen, Scotland, is also contemplated.

PAPER-YARN INDUSTRY GIVEN IMPETUS BY NEW DISCOVERY

Paper yarn has proved a satisfactory material for many purposes, and has even been used for clothing, especially in Germany, during the war. But such clothing attracted moisture and could not be made rainproof, mainly because the yarn used was "flat" or "half-flat." Recently, however, scientists, who have been experimenting with a view to correcting this fault, have found that by giving the paper strips a good twisting while they are being spun, the individual cellulose fibers become entwined; that is, the resulting yarn has gone through an actual spinning process. This would seem to open a wider field for the paper-yarn industry.



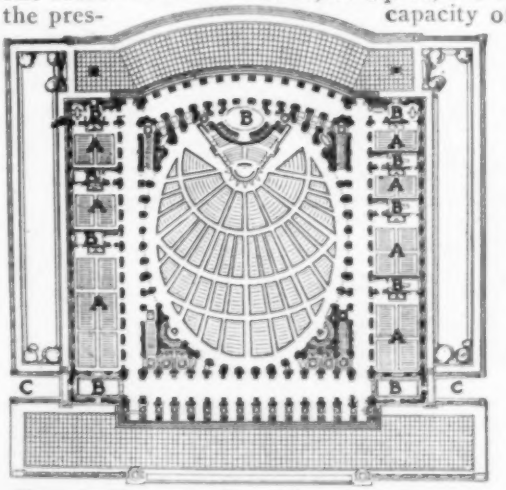
Attractive Temporary Buildings and Tidy Garden Plats Change Face of Venerable Common. This War Innovation Is to be Retained for the Needs of Peace



Front View of Proposed Memorial Hall to be Erected in Washington in Honor of Revolutionary and Present-Day War Heroes

NATIONAL MEMORIAL TO HEROES OF '17 AND '76

It now seems probable that one of the tangible fruits of the war, in the form of memorials, will be an immense convention hall to be located in the national capital, which strangely enough has no really suitable meeting place for large audiences. If the building, for which plans have been accepted and a splendid site secured through the coöperation of congress, is erected, it will be designated as a memorial both to the soldiers of '17 (and '18) and of '76. The reason for thus linking the heroes of the present with those of Colonial days is that George Washington himself is responsible for the idea of a memorial, having included in his will a bequest of $25,000 for the purpose. This was in the form of stock certificates, and was one of two gifts which congress gave him in view of the fact that he would accept no compensation of the usual sort for his services. In setting aside this gift in his will, Washington designated that it be used for the diffusion of knowledge.



Above is Shown the Floor Plan of the Proposed Memorial Structure. The Center Oval Is the Auditorium Proper, Seating 7,000 Persons. "A" Indicates Assembly Rooms, "B" Reception Rooms, and "C" the Carriage Lanes

While the original stock certificates have long since become of little value, the idea has never been lost sight of, and an organization was formed to raise money for the memorial. Our sharing in the great war interrupted the work of this society, but on the other hand the coming of peace has given it a new incentive, and so it is proposed to complete the fund (already $350,000 in cash, with many contingent promises in addition) and erect a great convention hall in honor of our boys in khaki and the revolutionary heroes. A splendid site has been granted by congress for the building—that now occupied by the old Pennsylvania Railway station.

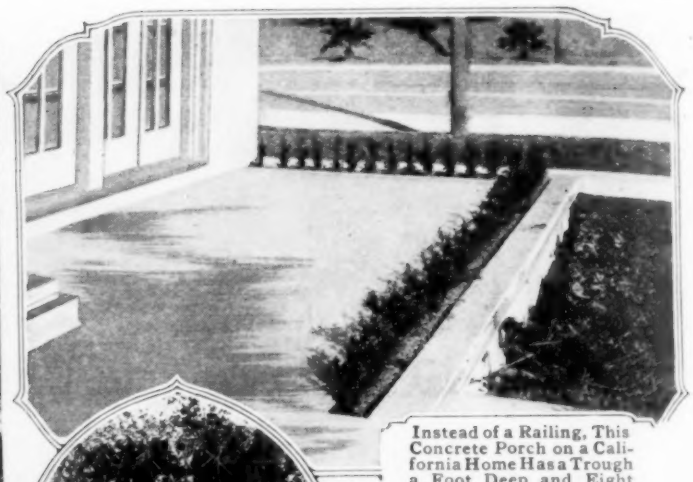
It provides for a main auditorium with a floor space of 38,500 sq. ft., with a gallery of 10,000 sq. ft., the two having a seating capacity of 7,000, and so suitable for inaugural balls, public receptions, etc., as well as conventions. Grouped about the main auditorium are several smaller halls. The second floor is to have a banquet hall, with a capacity of 600 persons, and rooms designed to serve as permanent offices for patriotic societies.

EFFICIENCY ON ITALIAN FARMS

The Italian ministry of agriculture is determined to make every acre in Italy do its bit. With this maximum production in view, an agricultural survey will be made to reveal every plot that is yielding less than it should. The backward farmer will then be given assistance in increasing the fertility of his land. In cases where the individual is unable, or unwilling, to coöperate, the government will insist on subletting or on a forced sale.

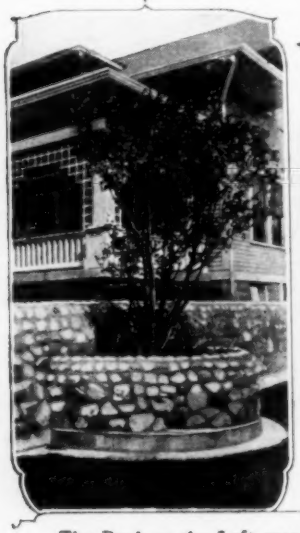
BITS OF OUTDOOR ART AMID HOME SURROUNDINGS

A Hollow Tree, with Its Dead Pulp Cleaned Out and a Little Gable Roof Erected over the Opening, Makes a Sheltered but Conspicuous Place to Hang Announcements



Instead of a Railing, This Concrete Porch on a California Home Has a Trough a Foot Deep and Eight Inches Wide Filled with Earth, in Which are Planted Evergreen Shrubs to Form a Hedge. The Trough Has Drain Openings, and the Porch Hedge Grows Nicely

Two-by-Four Uprights Support a Regular Pergola Top, Covered with Wild Grapevine, over This Seat Made from an Old Stump

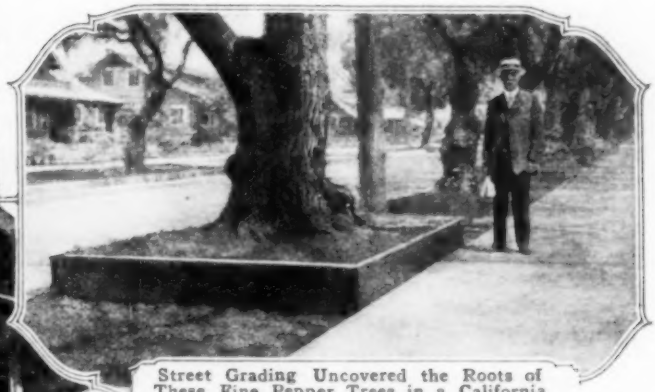


The Bush at the Left was Walled Up to Match the Well, Shown at the Right, and the Garden Wall, Beyond. This Old Well, Noted for Its Fine Water, was Protected and Greatly Improved in Appearance by the Cobblestone Curb and Arch Built About It. The Suspended Bucket Is Symbolical Only, as the Water is Piped to the House

This Bird House on a California Lawn Is Safe at a Low Altitude Because It is Made of Concrete, as Is Also the Imitation Stump That Supports It. Three of Its Six Sides, Facing the Prevailing West Winds, Are of Plate Glass; the Rest Are Wire Netting

HELP GRATIFY THE BEAUTY URGE OF SPRINGTIME

This is Called a Double Chimney Flower Box. The Two Boxes are Really Supported by Their End Beams, Imbedded in the Chimney. The Heavy Chains from the Roof Are Just for Effect



Street Grading Uncovered the Roots of These Fine Pepper Trees in a California Town. The City Forester Built Wooden Boxes About Them, Filled Them with Earth, and Painted the Boards Green

Eucalyptus Boughs Make Up This Rustic Arbor Entrance to a Southern California Estate. At the Base of Each Pillar, Climbing Roses have been Planted

A Civil War Veteran in a New York Village Carved This Totem Pole from an Old Tree. It Is 18 Feet High and Bears Relief Figures of 40 Animals, Birds, and Human Likenesses, All of Which are Painted in Various Tints. A Bird-House Community Occupies the Top

INKSTAND FOR DRAFTING ROOM PREVENTS COLOR MISTAKES

Draftsmen who work with varicolored inks, especially those troublesome fluids used in making hectograph drawings, are

The Pens Standing Upright in Front of the Bottles of Colored Inks Prevent the Draftsman from Taking the Wrong Color. He can Reach Only the Bottle from Before Which He has Removed the Pen. The Stoppers Rest in a Groove behind the Bottles

apt occasionally to replenish the pen from the wrong bottle, with temporarily disastrous results. An eastern engineer, whose office does much work of this kind, has devised an inkstand consisting of a wood strip with a row of holes in which the bottles fit snugly. A longitudinal channel behind the bottles holds the stoppers while the inks are in use. In front of each bottle is a small vertical hole in which a pen stands upright. With the pens in this "rest" position, the draftsman's fingers cannot reach any of the ink. Removing a pen for use, opens access to the bottle behind it, but to no other, and no error is possible.

HOSPITAL CALL SENDS SIGNAL UNTIL NURSE ARRIVES

Nurse calls in hospitals are generally merely pendant push buttons, whose flexible suspension cords are quite apt to be frayed through by the petulant handling of patients. An improved switch for this purpose is set in the wall, with a standard outlet box, and has a chain pull with a long linen cord attached to it. Just above the chain opening is a push button, which is the only means of turning off the signal when the patient has turned it on, thereby practically forcing a response to the call. The position of this button also identifies the calling switch when several use the same signal.

DANGEROUS ANTHRAX GERMS IN BRUSH BRISTLES

Anthrax, while essentially a disease of sheep and cattle, attacks man with great virulence when opportunity for infection offers. Several human cases have been definitely traced to the use of new shaving brushes in whose unsterilized animal-hair bristles lurked the germs of the malady. Occasional attacks are of record also among employes of brush factories. The danger, while not widespread, is sufficiently serious to have occasioned an order by the New York City health department that all dealers in bristles submit their stocks to it for sterilization. It is recommended that all new animal-hair shaving brushes be sterilized by boiling for two hours.

NEEDLE WITH CUT-IN HEAD FOR AEROPLANE FABRIC

Of late a needle particularly suited for sewing aeroplane fabric has come to attention. Cut-away sections adjacent to the eye—in the flattened sides as they might

Showing the Needle in Two Positions That Illustrate Its Peculiar, Flattened Head, Which Adapts It for Tough Fabrics

be termed in an ordinary needle—reduce the bulge of the thread. Because of this arrangement, the hole made by the body of the instrument is adequate for the easy passage of the looped thread. Obviously, the needle is adapted for other uses than the one mentioned.

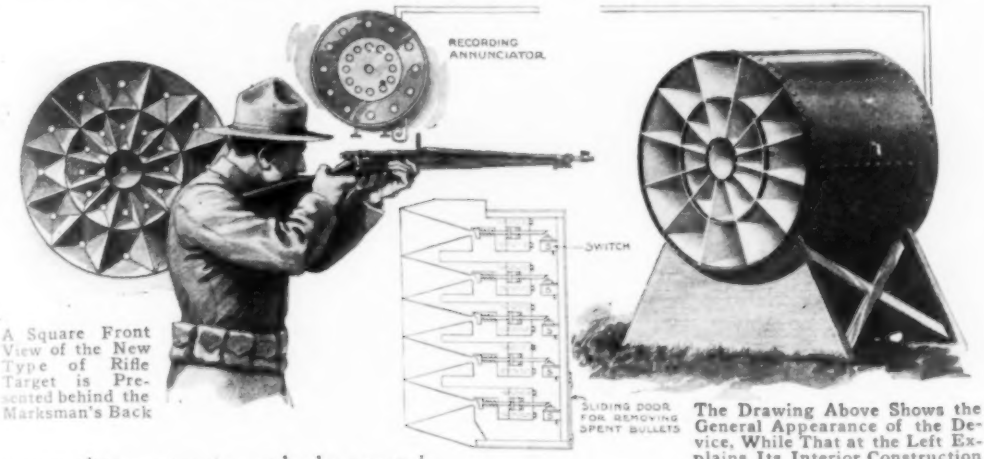
WIRING FOR FARM LIGHTING GAUGED BY POCKET CHART

Wiring a farmhouse or country home for electric lights is simplified by the use of a new pocket wiring chart, giving, without calculation, the proper wire sizes for all loads and lengths of circuit. The chart applies to standard 110 to 125-volt installations, and supplements one formerly issued for 28 to 32 volts. A 3½ by 5½-in. card contains all the data necessary for the work.

CELLULAR TARGET FOR RIFLE SCORES AUTOMATICALLY

Of novel arrangement is a recently patented bullet-catching and self-scoring rifle target that seems to embody several points of interest. It is composed of a series of open-ended receiving pockets with converging walls. Registering with a small opening at the rear of each of these is a shock-absorbing plunger supplied with an angular face that causes a bullet, upon impact, to be deflected downwardly into a salvage compartment. Movement of the plunger actuates a switch connected in the annunciator circuit.

The face of the indicator is divided into sections corresponding to those of the target. The cells of the latter may be of almost any desired number or arrangement, but in a 46-in. target designed for high-power rifles at 200-yd. range, they are grouped around the eight-inch bull's-eye in two concentric rows of 12 pockets each.



A Square Front View of the New Type of Rifle Target is Presented behind the Marksman's Back

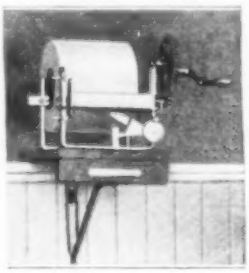
The Drawing Above Shows the General Appearance of the Device, While That at the Left Explains Its Interior Construction

ITALY BEARS BRUNT OF FUEL SHORTAGE AMONG ALLIES

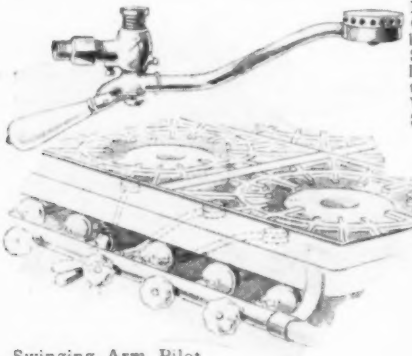
With her population as a whole going without coal for heating for many months of the war period, and a large part even being without gas for cooking, Italy was, without doubt, the worst sufferer from the coal famine of the last two years. Having a normal consumption of 10,000,000 tons annually, the country has been receiving only 7,000,000 tons, and the population was forced to use lignite, which is Italy's only domestic fuel. This commodity, which at best is very little superior to peat, has been produced on an average of 700,000 tons yearly in prewar periods, but the coal situation forced this production up 2,500,000 tons in 1918. To make matters worse, 120 out of a total of 128 gas plants in Italy were shut down in the early part of 1917, leaving only those in the larger cities in operation, and consumers were allowed the use of gas for cooking purposes during an aggregate of only four hours a day. Representatives of the Italian government urge an annual supply of 12,000,000 tons to avoid possible serious disturbances.

PAPER-ROLLING AND CUTTING DEVICE FOR BARBER SHOPS

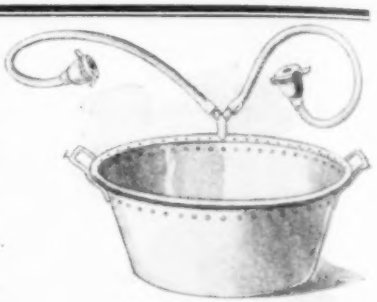
As a means of helping reduce the high cost of shaving, a Buffalo, N. Y., man has recently invented a machine for rolling and cutting shaving paper. These rolls go just underneath the headrest of the barber chair, a piece of paper being pulled out and torn off for each new customer. Heretofore they have been purchased from supply houses all rolled and ready to insert, and have been more or less costly. By using this new device, however, the barber has only to purchase a large supply roll, thus saving some money. The device automatically catches the paper, winds it, and cuts it off when the roll has reached the proper size. Since a roll can be wound in about 15 seconds, little time is lost.



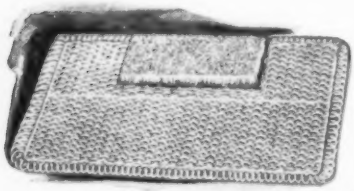
SOME NOVEL AND LITTLE-KNOWN ACCESSORIES



Dish Pan with Faucet Connections Enabling Water to be Sprayed Continuously through Perforations in Rim: Dirty Water Drains into Sink through Holes near Top of Pan



Swinging-Arm Pilot Lighter for the Gas Range, a Convenient Accessory in the Kitchen

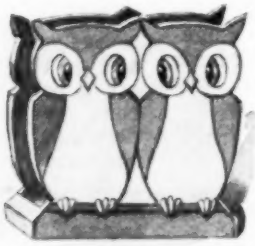


Combination Metal and Fiber Mat for the Porch Floor: The Inset is Neatly Fitted and Securely Held in Place

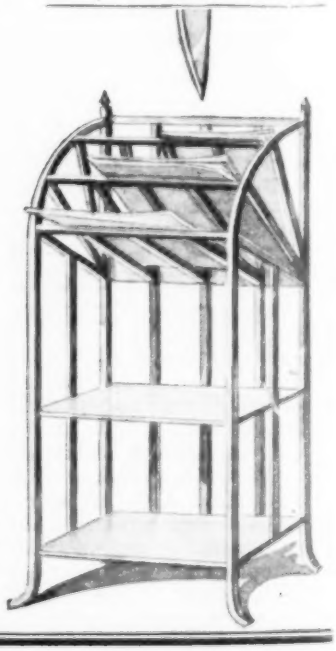
Used as Illustrated, the Fastener Prevents Delicate Garments from Slipping Off Their Hangers

Decorated in Bright Colors, This Humorous Little Sign cannot Fail to Attract Attention When Displayed on a Lawn

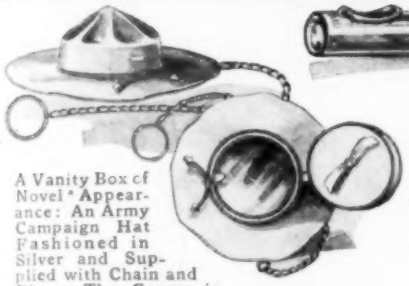
Nesting Supply Station, Containing Milkweed Silk, Thread, Hemp, and Horsehair, for the Modern Bird



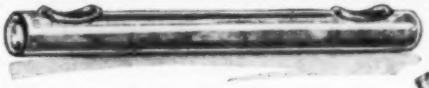
Wise Old Owls, Perhaps Night Owls, Back to Back and in Colors Unknown to Nature, Form an Attractive Holder for Playing Cards



For Library or Office, an Artistic and Substantially Built Magazine Stand of Solid Mahogany

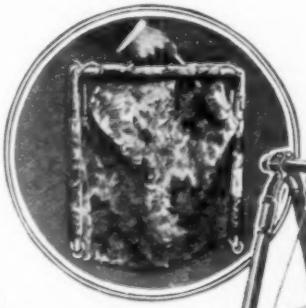


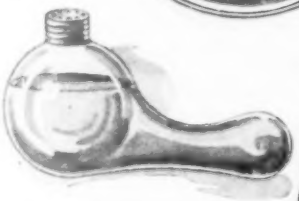
A Vanity Box of Novel Appearance: An Army Campaign Hat Fashioned in Silver and Supplied with Chain and Ring. The Crown is Hinged and Holds a Powder Puff



For the Smoker: A Neat Device That Makes a Humidor of an Ordinary Cigar Box and Keeps Stock Fresh

This Drying Frame Holds the Hair from Neck and Shoulders, Allowing Free Circulation of Air. Also It Shades the Eyes from Sun's Rays





For Use in the Household Laundry: A Clothes Sprinkler, Made of Glass, That Saves Time and Labor

This Swinging Cradle Occupies Little Room and may be Stored in Compact Space. When Folded, as Shown in Circle, a Shopping Bag is Formed

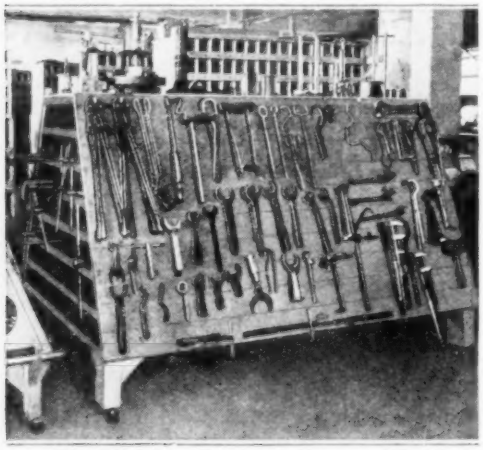
To Protect Sharp Pencil Points: A Wooden Cap, Decorated in Colors

A Dainty Laundry Bag for the Nursery: The Bag is Made of Colored Poplin and Buttons to the Wooden Frame, Which is Tastefully Decorated

This Washing Machine is Fitted with Glazed Ports and an Electric Lamp, So That the Interior may be Viewed without Raising the Cover

HANDY TOOL RACKS HAVE HELPFUL INDEX MARKS

Wooden tool racks of special design, mounted on casters, in the shops of an automobile factory have proven time-savers for the workmen. One of the racks is a truncated pyramid, and the other is A-shaped in its cross section. On the slanting sides of each are numbered hooks for the tools, which are numbered correspondingly. That there may be no mistake in replacing a tool, the outline of each is painted in red in its proper place on the side of the rack.



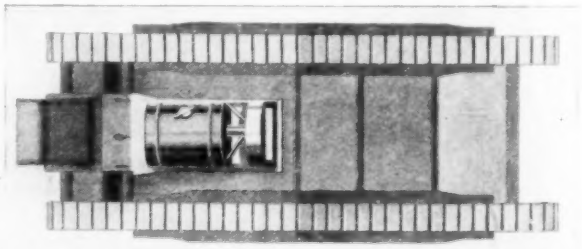
Tool Racks in the Shop of an Automobile Factory on Which the Place of Each Tool is Designated by a Number and the Outline of the Tool in Red: Extra-Long Tools are Kept on the Shelves of This A-Shaped Rack

DIRECTION AND VELOCITY OF WIND DETERMINED BY SOUND

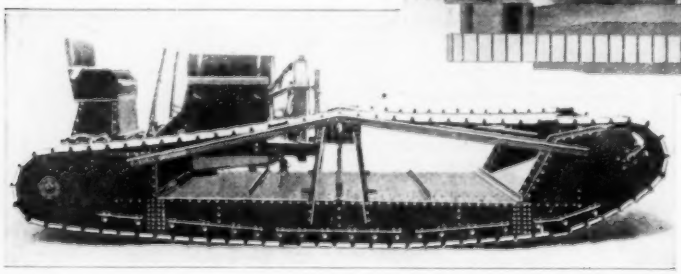
Sound ranging, invented for the use of artillery, is expected to become valuable also in the study of meteorological problems. Small balloons, filled with hydrogen, and carrying small shells that burst at regular intervals, are allowed to rise freely and be carried by the various currents of the atmosphere. Special apparatus registers the shell explosions, and these enable the position of the balloon to be accurately determined. From these points, when plotted, the trajectory, or course, of the balloon can easily be traced. Using the sum of the projections, on a horizontal plane, of the positions at which the explosions took place, and the knowledge of the time intervals between these explosions, the velocity and mean direction of the wind can be determined between certain altitudes. The explosions can be heard at distances up to about nine miles, and the small balloons can be used in winds of high velocity, when captive balloons and kites would be unmanageable.

ENGLISH ARTILLERY TRACTOR HAS CARGO SPACE

English military tractors have no springs between frame and track rollers, in which respect they differ from French types with an individual spring for each roller or truck, and American methods of carrying the rollers on a spring-mounted truck. One model of English tractor, brought out by the war, has 19 truck rollers on each side of the frame, or "hull" as the British call it. The steel-plate hull of this machine, which is used for both towing and cargo carrying, has a large load space between its track treads, ahead of the engine. The track rollers are rigidly supported by the vertical steel side plates that inclose the lower portion of the frame.



This Plan View Indicates the Area of the Tractor's Cargo-Carrying Space, All the Forward Half of the Deck



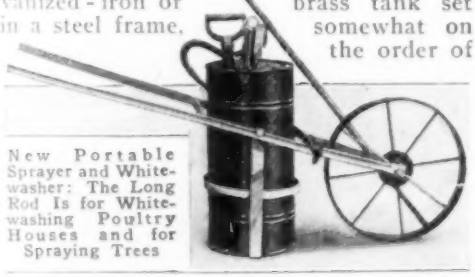
Large Cargo Space Is the Feature of This English Military Tractor. The Rollers, 19 on Each Side, are Rigidly Mounted without Springs

TO USE AVIATION FIELDS AS FARM-INSTRUCTION CAMPS

Just when the various governments are beginning to discuss ways and means of utilizing the vast army training camps that have been established, Canada comes forward with a solution of one part of the problem that should prove highly effective. In the Dominion, aviation fields are being converted into agricultural schools. It would appear that they are ideal for the purpose. They can accommodate close to a thousand men; mess halls and living quarters, shops for repairing tractors and implements are all there, ready for use, and with few and easily made changes in the hangars they will provide housing for live stock. Ample grounds are also available, so that a great variety of crops may be studied.

NEW PORTABLE SPRAYER WILL BE BIG AID TO FARMER

The gardener, the poultry man, the nurseryman, or the farmer, who is somewhat of a combination of all three, will be interested in a new machine that has just been put on the market which performs the triple duties of sprayer, white washer, and disinfector. The machine is composed of a galvanized-iron or brass tank set in a steel frame, somewhat on the order of a wheelbarrow. The tank is fitted with a double-acting brass pump, and a hose with an anticlog nozzle. There is also a spraying rod for elevating the spray to trees and for whitewashing purposes.



New Portable Sprayer and Whitewasher: The Long Rod Is for Whitewashing Poultry Houses and for Spraying Trees

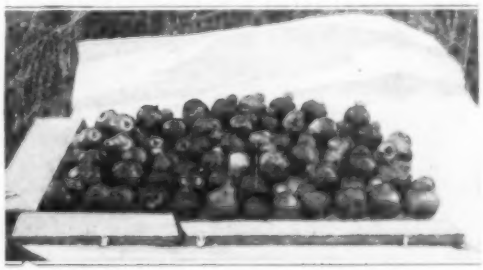
MAILING AND REPLY ENVELOPE MADE IN ONE PIECE

The common return envelope has proven so desirable a spur to business that methods for its economical production are interesting. A California inventor provides an envelope with both open edges terminating in flaps. A short flap on the front seals the mailing envelope, and a printed line requests the recipient to open it on that side. When this is done the second flap is revealed, tucked inside, and may be withdrawn and pasted outside, over the original address. This second flap has the return address printed on it, and needs only a stamp to carry the contents back to the sender. The envelope is made in both regular and "window" styles.

When This Envelope is Slit Open along the Line Indicated, the Printed Auxiliary Flap Inside may be Pulled Out and Pasted over the Old Address, Making It a Return Envelope

DOUBLE APPLES NEW ADDITION TO NATURE'S MANY FREAKS

Good old Dame Nature has given us many wonderful things, and also many freaks. While in a good many cases she has had the help of men who have made a study of special phases of plant life, she can take full credit for a large majority of them. Now, up among the apple orchards of the great Northwest, she has added new laurels to her already long list by producing some really remarkable double apples: "Siamese-twin" apples, if you please. In one shipment of 900 boxes there was more than a boxful of these curious products of fruitland. The fruit will be exhibited merely as a curiosity.



Double Apples Picked at Yakima, Washington: In Some Cases the Second Apple Is Not Very Pronounced, While in Others It is Full-Grown

MOTORCYCLE SLED ADDS TO JOY OF WINTER SPORTS

Just what to do with a motorcycle when the snow covers the ground, and the rivers and streams are frozen over, may have puzzled many owners. There is no pleasure in a machine while it is stored away until spring opens up the roads to travel. Many contrivances have been devised for converting the machine for winter use, and here is a new solution of the problem, offered by an Albert Lea, Minn., man. He has equipped his car with runners and a specially built rear wheel fitted with protruding points which catch in the ice, or roadway, and transmit the driving power. He is able to travel on either ice or snow-covered roads, and he claims, with the use of this device, he can attain even greater speed on the ice than with a regular motorcycle on land.

Two Views of the Motorcycle Sled Designed to Permit the Use of a Machine the Year Around: The Builder Claims Even Greater Speed Is Possible on the Ice Than on Regular Roads with the Ordinary Motorcycle

SPLIT HANDLE ON LAMP GUARD MAKES WIRING EASY

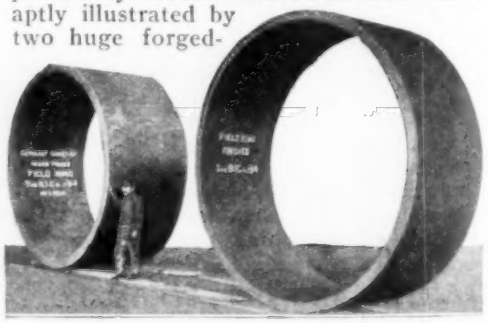
When using an incandescent lamp on a long cord as a portable light, a lamp guard with a handle adds to both safety and convenience. The handle, however, is ordinarily hard to wire. A lamp guard made of expanded steel, which has lately appeared on the market, has its wooden handle split lengthwise so that the whole guard opens on a hinge at the end of the steel net. It is thus easily clasped about the lamp, the cord running through a channel in the split handle. When it is closed and locked the lamp is protected against breakage and theft, yet may be quickly removed when desired.

"CANNED" BLOOD IS EMPLOYED IN TRANSFUSION OPERATIONS

Credit is due to the exigencies of war for another important triumph of modern surgery in perfecting operations of transfusion, for it is no longer necessary for the donor of the blood and the patient who is to receive it to be brought together. Human blood, it has been discovered, may be preserved for several weeks—a month represents about the limit of time—and used when needed. War surgeons found, for instance, that the improvement of patients was equally marked when they were supplied with blood that had been kept three weeks or more, as when "fresh" blood was used. The importance of the latest technical change in this operation is almost obvious. It lies chiefly in the advantage of having a stock of blood at hand at all times for the emergencies that constantly arise. In other words, in critical cases it enables transfusions to be made without delay. As a side light, in the future there undoubtedly will be a permanent market for human blood, rather than the unstable one that has obtained heretofore.

RINGS FOR TURBINE ENGINES FORGED FROM SOLID STEEL

Just what wonders may be accomplished by modern industrial methods is aptly illustrated by two huge forged-steel rings recently completed. These rings were forged and pressed from solid-steel ingots and are to form the fields of turbine generators for a Niagara Falls



Two Steel Rings Recently Completed to Form the Field of Turbine Generators: The Rings are Forged from Solid-Steel Ingots and Are in One Piece. That on the Left Is the Rough Forging, While the Other Is the Finished Article, after being Machined

hydroelectric plant. In forging the rings, the ingots are first heated almost to a dripping heat in soaking pits, or furnaces, and are then "kneaded" into shape and made hollow by forging presses and hammers. This process is continued until the rings reach the desired size, when they are machine-finished. Forging of field rings is not an easy feat, for the finished product must be as nearly free from imperfections as it is possible to have it.

HIGH-SCHOOL BOYS HELP PLOW VAST TRACT IN QUICK TIME

One of the biggest undertakings on record in the way of speedily preparing untilled soil for cultivation, was begun last spring in Montana, and is still in progress. The tracts being broken, aggregating 200,000 acres, are lands belonging to the Indians and have been leased through the government, with a view to adding to the food supply. In the crew of workers stationed near old Fort Custer, on the Crow Reservation, were a score of Minneapolis high-school boys, who with others had use of nearly 50 tractors. In one day 14 of these machines, pulling plows that turned a total of 100 furrows at once, plowed 365 acres, which, it is claimed, is a world's record. Two of the boys, one on a tractor and one attending to three seeders, seeded 189 acres in one day.

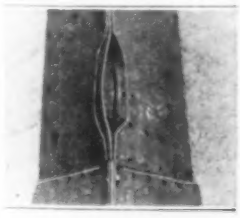
INDIAN'S WHEEL LIFTS WATER FOR FIELDS WITHOUT COST

The resourcefulness and mechanical ability of a full-blooded Indian in the state of Washington is illustrated by a large water wheel which he constructed for irrigation purposes. It is supported in a narrow stream by a framework of logs and is composed of 16 broad paddles, each having attached to one end a wooden box which fills with water as it descends into the stream and discharges into a trough when it nears the top of its circuit. No power other than that of the current is required to lift the water the distance of eight feet.

A Water Wheel Devised by a Full-Blooded Indian in the State of Washington, Which Lifts Water Eight Feet and Discharges It into a Trough, Whence It Flows into Irrigation Ditches

STEEL PLATE ON BRIDGE PIER BUCKLED BY ICE GORGE

How tremendous is the pressure exerted by the breaking up of ice in a heavy current was demonstrated at Battleford, Sask., Canada, where a railway bridge crosses the Battle River on concrete piers. Steel plate, ½ in. thick, surrounds the piers, its edges bolted together through steel ribs 1 in. thick. When the ice had gone out, this inch-thick corner was found to be twisted and buckled quite out of shape, in spite of the almost negligible purchase offered by the tightly fitted joint.



NEW HARBOR TO FACILITATE RAW-RUBBER IMPORTATIONS

A large part of the raw rubber used in the United States is imported from the island of Sumatra, belonging to the Dutch East Indies. Lack of shipping facilities have, heretofore, greatly hindered rubber importers, particularly on the east coast near Medan, where several large rubber plantations are situated. The raw product has had to be loaded on lighters and then transferred to ocean vessels at sea, requiring double handling. In recognition of this, the authorities have made plans to dredge a harbor at Belawan, Medan's seaport, deep enough to accommodate the largest vessels. This harbor is to cost approximately $4,000,000 and will take about three years to complete. Once in service, it will greatly expedite overseas shipments of crude material.

THE CHILDREN, IN STUDY, WORK, AND PLAY

Sixth-Grade Pupils of State Teachers' College, Greeley, Colorado, Armed with Shovels, Built a Big Contour Map of North America on the School Campus as a Permanent Patriotic Reminder and an Impressive Geography Lesson

Toy Airplanes Interest the Little Fellow at the Left More Than Bow and Arrow or Sling Shot, Which They Resemble Only in Their Method of Propulsion

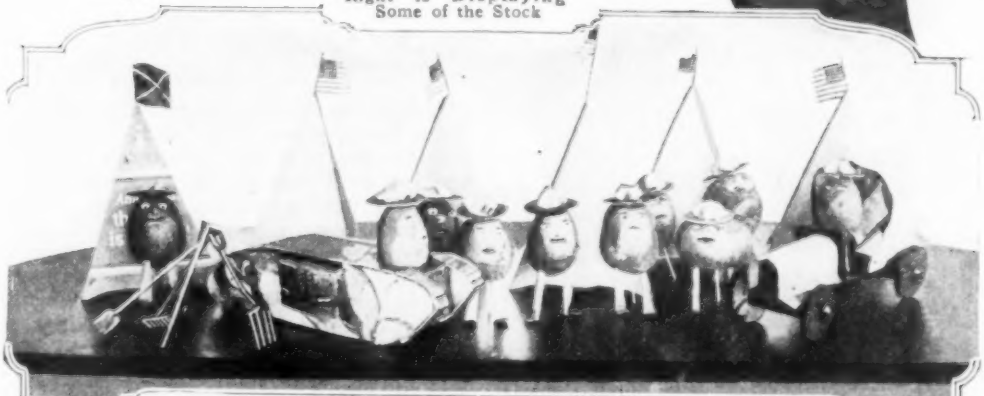
This Six-Months Old Baby was Picked Up on a French Battle Field at the Age of Nine Days, and Is the Only Foundling So Far Permitted to Leave France

A Boy in Pasadena, California, Has a Treasure Island of His Own, with a Playhouse Cabin on It, Reached by Stepping Stones from the Mainland of His Father's Lawn. There Is a Spray Pipe So He Can Make It Rain When He Wants to

MAINTAIN THEIR PATRIOTISM IN PEACE TIME

Filipino Children of Santa Clara School, Santa Cruz, Manila, are Still Making Liberty Gardens with Enthusiasm and Success, and the Prospective Crop Promises to Exceed Last Year's

Poultry Raising Is a Regular Study Now in the Public Schools of Cincinnati, Ohio, the Board of Education Prescribing Half-Day Classes. The Pupils Build Their Own Hen Houses, as Seen at the Left; the Boy at the Right is Displaying Some of the Stock



This Camp of the Potato Brigade was Originated by a Pittsburgh, Pennsylvania, Man to Amuse the Children, but Some of Larger Growth have Also Smiled. Faces are Marked on the Potatoes, and Toothpick Legs are Equipped with Paper Leggings

METER ON DASH TELLS LOAD CARRIED BY TRUCK

At any moment when the driver of a motor truck wants to know the weight

BY COURTESY OF MOTOR

With the Battery Case and Voltmeter Mounted on the Dash of a Truck and the Rheostat Connected between the Body and the Rear Axle, the Driver can Read the Load by Pressing the Button

of the vehicle's load in 50 or 100-lb. units, he can tell at a glance, by pressing a button and looking at an instrument on the dash. The visible part of the device is a pressed-steel case containing dry cells and a voltmeter, with a push button just below the dial. Mounted under the truck floor, over the rear axle, is an inclosed rotary rheostat. A cable running from it and attached to the rear axle varies the position of the rheostat and its resistance as the truck springs are deflected by the load, and the result registers on the voltmeter in front.

ITALIAN ARTIST DESIGNS UNIQUE WAR SOUVENIR

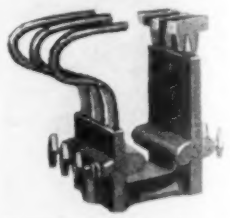
Souvenirs of the great world war have been extremely plentiful, and of all kinds and descriptions, but it has remained for an Italian artist to produce a really unique design. Working at odd times over a period of nine months, he has hand-hammered out of copper a stand 30 in. high and 15½ in. across the base. The upper portion is decorated by portraits of rulers of the allied countries and of Lincoln and Washington. Around the bottom are caricatures of the kaiser and von Hindenburg, the allied flags and the American Eagle being used as decorations. The portraits and decorations are all in bas-relief, and when it is considered that the artist fashioned his own tools for this work, the stand is really a remarkable piece of art.

BY COURTESY OF THE JEWELERS' CIRCULAR

Two Views of a Stand Hand-Hammered from Copper by an Italian Artist: The Portraits and Caricatures Thereon Are Exceptionally Good Likenesses

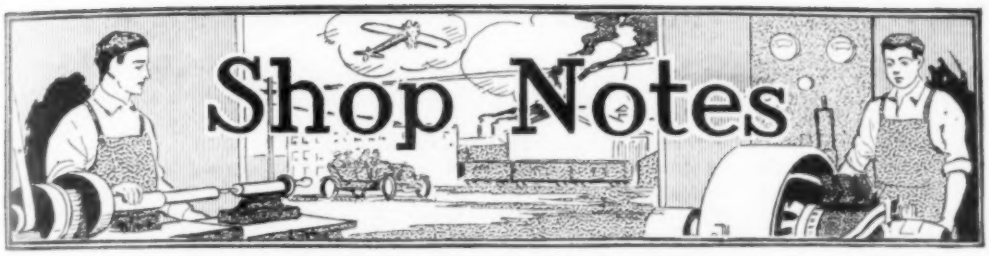
GLASS-BLOWER FIRES FOR BENCH WORK

Such comparatively delicate work as finishing incandescent lamp bulbs and sealing in wires has led to considerable improvement in the fires used by glass blowers. One instrument provided for this class of work has slotted burners accurately machined from solid rolled bars, valves held in position by collar nuts which cannot be removed, and a machine-finished iron base which clamps solidly to a plate on the workbench. All rubber connections are kept below the bench, and the smooth-drilled passages are readily cleaned.



NAVY AGAIN ABLE TO ACCEPT VOLUNTARY ENLISTMENTS

Owing to the large amount of publicity being given the demobilization activities, the fact that the navy is again seeking enlistments and is offering notable opportunities to young men who desire to become electricians or machinists by trade, has not become generally known. Enlisted men who have a theoretical knowledge and have had some practical experience in these lines of work, are given an opportunity to take a complete course in the Machinist School and the Electrical School, where they can obtain a much higher degree of knowledge than would be possible from general civilian experience.



Tools for the Victory Garden

By R. J. SLOANE

WHILE it is entirely possible to make a good garden with tools of the types that have been in use for generations, there is no good reason why the modern back-yard farmer should not take advantage of the improvements suggested by past experience, and provide himself with tools that do the work more quickly, more easily, and with more satisfactory results.

Hill Marker

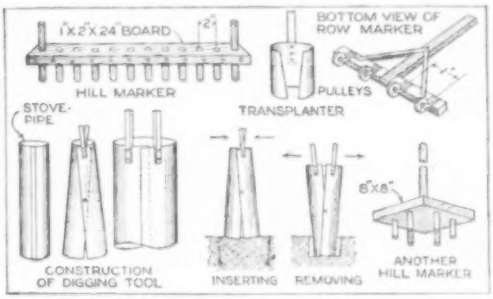
The planting of seed is no longer a matter of guesswork. It is well known now that the spacing of plants in the row has a great deal to do with the yield, both in quality and in quantity. The hill markers illustrated not only make the spacing of the plants a simple matter, but they compact the seed bed slightly, which is very desirable according to modern scientific theory. The hill marker is merely a light wooden strip fitted with wooden pegs of the proper length, and spaced the proper distance apart to suit the requirements of the particular variety of seed being planted. The marker is pressed into the soft earth along the guide line, rocked slightly, then lifted up, and the operation repeated as many times as necessary. The result is a series of holes spaced to allow the plants the correct amount of growing room, with the proper depth, and compacted sufficiently to insure quick germination and rapid growth. The seeds are easy to plant with such preparation, easy to cover with dirt, and will grow uniformly if the seed is good.

Row Marker

The row marker shown in the sketch is very handy to use in connection with the hill markers. The first row must, of course, be laid off with line and stake, but the row marker is used to lay off the rest of the garden, and the result is that all the rows are parallel and evenly spaced, making not only a good-looking garden, but one that is easy to cultivate. The marker is merely a frame which supports four clothesline pulleys. These are spaced 1 ft. apart, the common distances between rows being 1, 2, and 3 ft. When the marker is drawn across the soft earth, it leaves four depressions which are easily followed with the hill marker, or with the digger and transplanter to be described.

Transplanter

The majority of the better gardeners of today sow their seed in seed flats indoors, long before the weather is fit for garden-



Practical Tools for Marking the Hills and Rows, Digging Holes for the Plants, and Transplanting Them Are within the Reach of Every Gardener

ing outside. When the seedlings are about 3 in. high, or have three leaves on them, they are moved to a cold frame outdoors. Then, when the weather is good enough, they are transplanted to the garden. These different operations are not hard to carry out if the proper implements for the work are at hand. The simple transplanter and the digger shown in the drawing were designed for two different classes of work.

To remove plants for the second transplanting, a tool made from a tin can and a stick proves of much service. It will make the new hole in the soft, moist earth, will remove the plant without disturbing the earth around its roots, and will place it in its new location, the whole operation consuming only a few seconds. After the top end and sides have been cut out of the can, the edges should be trued, then filed sharp and smooth. A section is cut from one side, leaving an opening

which is larger at the top than at the bottom. On the opposite side of the can a stick is nailed, with the end cut tapering so as to offer as little resistance as possible when the tool is pushed into the earth. To use, the transplanter is placed around the plant and pressed down into the soil, cutting all straggling roots. It is then easily removed, without loosening the dirt around the roots, and is placed gently in the hole prepared for it.

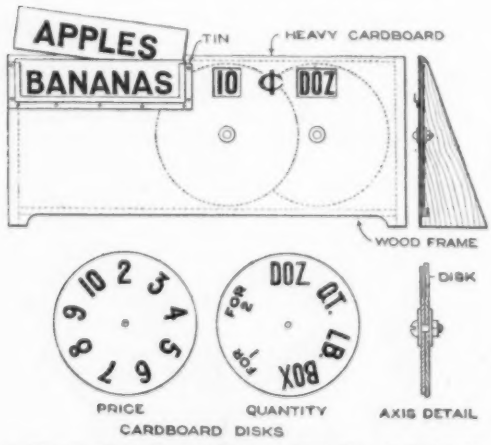
When the transplanter is pushed into the soil, the lower edges are forced together so that the tool cuts a conical hole. In removing the transplanter, care is taken to hold it tightly against one side of the hole, so that it will retain the dirt. When clear of the hole, the handle is lowered until the tool is horizontal. It can then be lifted without the dirt escaping.

Digging Tool

Although similar to the transplanter described above, the digging tool is even handier. A 1-ft. length of 4-in. stovepipe, or galvanized pipe, is opened at the seam, and the edges hammered smooth. A hole is drilled in each edge, near the center of the pipe, and a small stove bolt is used to hold the edges together. It must fit loosely enough so that when the top edges of the pipe are forced apart the lower edges will close together, the pipe edges forming a sort of scissors, with the bolt as a pivot. Two 6-in. strap-iron handles, riveted to the upper edges of the pipe, will complete the tool. The main uses of this tool are digging plants from the hotbed, and digging holes to set them in. While the transplanter described above is excellent for small plants, the digger will handle almost any size plant, and digs the holes for them much more rapidly. To use, take hold of the handles, and press them together slightly, thus forcing the bottom of the pipe to expand. Then push the tool into the soft earth, using a slight circular motion, until the proper depth for the hole required is reached. By pulling the handles apart, the lower part of the pipe is made to pinch the earth together, and it may be lifted out and thrown to one side. The result is a clean-cut hole. Since the operation takes but a second, it is possible to dig row after row of holes in a very short time. Also, it is possible to dig plants from the cold frame or hotbed in the same way, and with the same saving of time. The two operations, when combined, make it possible to set out a large bed of plants very quickly, and since this method does not disturb the roots of the plant, it does better work than most methods. The digger and the marker are particularly useful in large gardens.

Adjustable Sales Sign

A variable sign made from pasteboard and two blocks of wood, as shown in the sketch, will make a good appearance in any retail store. The material on which the price is being given is described on a card inserted in the rack in the upper left-hand corner. The two dials are turned so as to indicate the proper number of cents per dozen, quart, pound, etc. The space below can be used for any general advertisement. In order that the two disks may be set as close to each other as indicated, one must be lapped over the other. As the disks are merely ordinary cardboard, this does not require any change in the mounting, except that a washer can be inserted between the disk and the heavy cardboard face on one of the two center screws.—P. P. Avery, Garfield, N. J.



A Touch of the Finger Changes This Sign to Indicate a Changed Price for the Article

Reading Marks Stamped in Metal

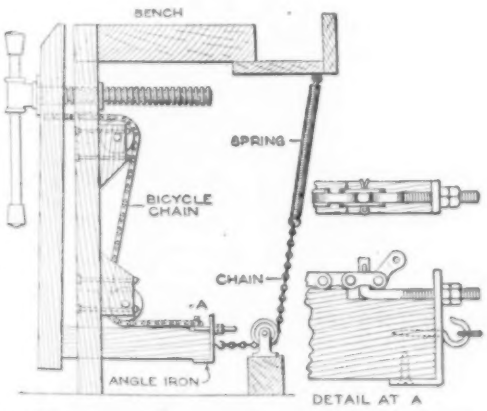
Many objects made of sheet metal have letters or numbers stamped in them which are sometimes difficult to read. A thermometer, whose metal had the figures stamped in it, was much improved by the process of painting the scale with heavy white paint from the bottom of a can, and carefully scraping the surplus with the edge of cardboard. The stamped

numbers were left filled with the paint, and thus made easy to read.—C. H. Chapman, Deer River, Minn.

Parallel Motion for Bench Vise

The old-style wooden bench vise is still a very popular and useful part of the carpenter's bench. As ordinarily used, it has the disadvantage that the jaw does not move parallel with the side of the bench, and the lower end has to be controlled by some means independent of the vise screw. The illustration shows how, by means of two chains and a spring, the bottom of the vise may be made to move with the top; that is, to remain in the same angular position relative to the side of the bench.

A discarded bicycle, or motorcycle, chain is fastened to the jaw of the bench vise just below the screw, and passes through the side of the bench, over one of the rollers and under another, to the fastening of the other end, at A. To the angle iron placed at this point is also fastened a chain leading around a pulley, and up to a long coil spring attached to a screw eye. As the vise is opened, the bicycle chain pulls the lower end of the vise jaw out exactly the same distance that the upper end moves. As the vise is closed, the spring pulls the lower end in, keeping the bicycle chain taut. The end of the bicycle chain, at A, is pinned over the end of an L-bolt, shown in the detail. An adjustment is thus provided, by which the vise jaw may be kept parallel with the

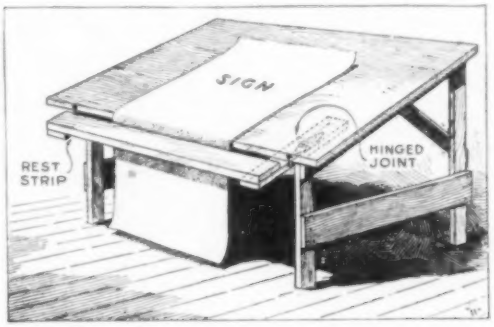


A Mechanism Made from Odds and Ends Provides a Bench Vise with a Parallel Motion

side of the bench, or the upper end slightly closer, so that the work is always gripped tightest at its upper edge.—Chas. S. Rice, Washington, D. C.

Bench Attachment Protects Sign While Painting

Long signs are difficult to paint, since it is not possible to lay all of the paper upon the drawing bench at once. The



A Rest on the Sign Painter's Desk Protects Long Signs from Creasing and Soiling

sign painter often spoils the sign by leaning against the paper where it goes over the edge of the bench, thus creasing and soiling it.

The attachment shown in the drawing protects the sign by providing a rest, against which the painter may lean without touching the sign itself. The pieces which hold this rest are hinged under the table top, so that the attachment can be dropped out of the way while painting small signs. It is held in place, when in use, by hooks which catch into screw eyes in the edge of the table.—Arthur J. Kelly, Brooklyn, N. Y.

Gardening in the Cellar

Mushrooms are not the only plants of food value that can be grown in a cellar, or in any warm and rather damp place where light is absent. Success has attended the cultivation of such plants as rhubarb, endive, sea kale, etc., all of which are highly valued in a blanched condition. Strong clumps of roots are packed away in boxes with a little soil. These are placed on the floor of the cellar, and a little water is given as required. The rate of growth is astonishing, even in winter. Owing to the absence of light, the stems elongate much more rapidly than under normal conditions.

¶ To make the rollers on roller skates wear evenly they should be changed from time to time, using them on both the inner and outer sides of the skate.

Knob on Stairway Rail an Aid to the Blind

In England, where many men have lost the use of their eyes through wounds received in the war, the device illustrated has been adopted in the houses of some

The Blind Man Quickly Learns the Exact Position of the Steps Relative to the Knob

of the sightless heroes. It is a knob or button placed on the stairway rail, so that it indicates the exact position of the person touching it with reference to the steps in front of him, thus making it unnecessary for him to locate the steps by means of his stick.

Burning Soil to Release Plant Foods

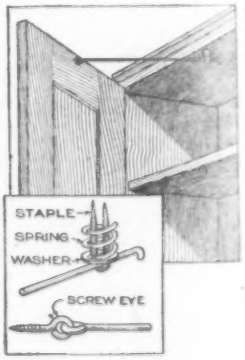
Certain soils of volcanic origin are notable for their fertility. The passage of earth through fire helps to set free plant foods that are unavailable in their original state. Following up this idea, it has been shown that by burning the soil used in greenhouses, and to a limited extent in gardens, its condition may be improved to a greater extent than by the adding of fertilizers. It is only possible to burn a portion of the soil, and this is carried out in the following manner: Heaps of any kind of rubbish that will burn are collected, and the soil, in a fairly dry state, is intermixed. The whole pile is then set afire, and by the time the rubbish has been reduced to ashes, the burning of the soil will be completed. In its new state, potash and other valuable constituents have been added by the burned trash, and released in the soil, in such a form that they can be used by the plants. This burnt soil, with the ashes, is simply dug lightly into the ground, and the resulting crops are thereby considerably increased.

Air Tank Carried on Auto

An old steel tank, of the type widely used, until recent years, to contain dissolved acetylene for automobile headlights, was attached by a car owner under the rear seat of his car, to carry air under pressure for use in case of tire trouble on the road. The tank was of the largest size used for acetylene headlighting. It was provided with a high-pressure rubber hose, long enough to reach to any of the tire valves, and was equipped with a pressure gauge, similar to those found on tire pumps. Such a tank will easily withstand any pressure ordinarily found in garage air tanks, and it was found to contain sufficient air at such a pressure to inflate two tires. The tank was filled by means of an ordinary tire valve, screwed and soldered into the side of the tank.

Holder Keeps Cupboard Door in Any Desired Position

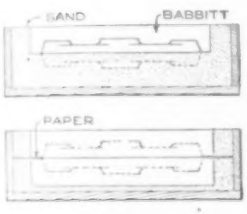
A simple device for holding a light door at any point can be made in a few minutes from a short piece of stiff wire, a screw eye, a wire staple, and a small spring. With a round-nosed pair of pliers turn a small loop on one end of the wire, and attach it to the screw eye, which should be screwed into the back of the door about one-third of width of the door from the hinged edge, near the top. The staple, in which the wire slides, should be narrowed until the sides are ¼ in. apart. Place it on the underside of the top of the cupboard, about ½ in. back from the edge, and an inch or two farther from the hinge than is the screw eye. The exact position is easily found by trial, before driving in the staple. Procure or make



a small coil spring, about ¼ in. in diameter, and place this, with a washer, over the staple before inserting the wire. The spring should exert enough pressure on the wire to hold the door by friction, in any position. Bend the end of the wire down to act as a stop for the door when wide open.—Morris G. Miller, New Rochelle, N. Y.

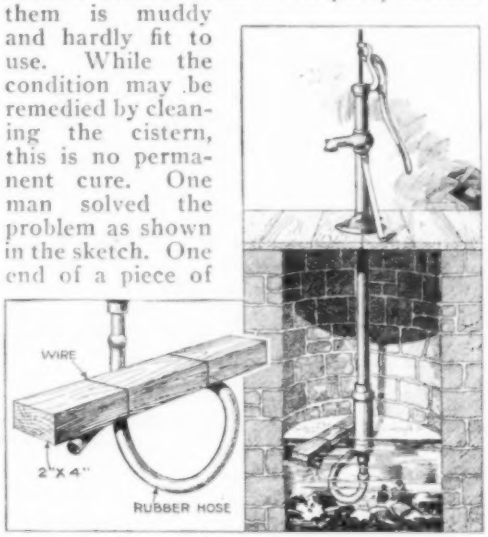
Templates for Irregular Castings Made of Babbitt Metal

Where a number of iron or brass castings are to be drilled without gauging accurately the position of the holes from any finished surface, and especially where the casting is of such a shape that it will not rest flat on the table of the drill press, a template made by pouring babbitt around one of the parts, or a jig made by boring two of these templates to fit together, will be found very useful. To cast the template, or the first half of the jig, simply sink the iron casting in a box of sand down to its horizontal center line, and pour the babbitt around it. After the metal has cooled, remove both the casting and the babbitt template, and drill the holes, carefully laid out, through the casting, continuing them on through the template. If the part is one which will not rest level on the drill-press table, and it is therefore desired to complete the jig, this is done by sinking the babbitt template into sand, as shown below, placing in it another part which has not yet been drilled (or the first part with the holes plugged with wood), and pouring babbitt again to the same thickness. Pieces of paper, laid between, will prevent any danger of the two babbitt castings adhering to each other. After this second babbitt piece has cooled, the holes are continued through it, using as templates the first babbitt casting and the part from which it was made. The jig is now complete, unless it is desired to add hinges or clamps to enable it to be used more rapidly. The price of babbitt metal is so high that this method of making jigs would hardly be economical where the jig is to be kept indefinitely, but where one is desired on short notice for temporary use, it is a good method to remember.—Earl Pagett, Cherryvale, Kan.



Float in Cistern Provides Cleaner Water

Many cisterns have so much sediment in the bottom that the water pumped from them is muddy and hardly fit to use. While the condition may be remedied by cleaning the cistern, this is no permanent cure. One man solved the problem as shown in the sketch. One end of a piece of hose was attached by wire to a short length of 2 by 4-in. lumber, the other end of the hose being attached to the lower pipe connection of the pump cylinder. This block, floating upon the water in the cistern, holds the free end of the hose above the sediment at all times. The water pumped from a cistern equipped in this manner is always clear and contains a minimum of dirt.—Merlyn C. Mayo, North Loup, Neb.



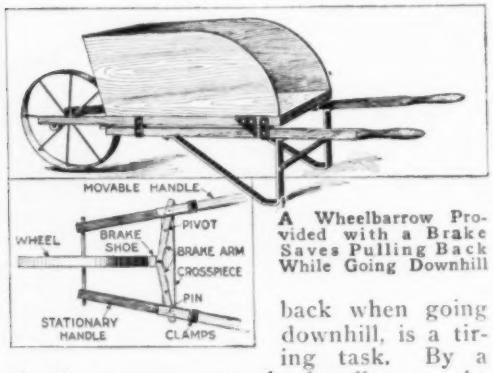
A Float Holds the End of the Hose above the Sediment, Insuring the Pumping of Clean Water at All Times

Hinge Makes Key Vise

When in need of a vise to hold keys, or other small objects, it is only necessary to secure a strap hinge and two screws. One strap of the hinge is screwed to the edge of the workbench, and the other strap closed over the key, or other object, by tightening a screw inserted through the end holes of both straps. This cheap hinge vise is strong enough for many small jobs, and can be attached to the workbench in a few minutes.

Automatic Wheelbarrow Brake Helps When Descending Inclines

To hold up the handles of a loaded wheelbarrow and at the same time hold



A Wheelbarrow Provided with a Brake Saves Pulling Back While Going Downhill

back when going downhill, is a tiring task. By a simple arrangement, the handles may be made to brake the wheel automatically when going down, and as automatically release the brake as soon as level ground is reached. The steeper the hill, the harder the brake will be held against the wheel. The regular handles of the wheelbarrow are cut off at the back end of the body. Then, under these, a second pair of handles are fastened by strap-iron links, on both sides of the handles, so that they can move back and forth 2 in. Brake arms reach from each handle's front end to the brake piece that fits against the wheel. The length of these will depend upon the width of the wheelbarrow, the average length required being about 12 in. The brake arms are pinned to the handles, and work on a pivot at the center, which is fastened into the crosspiece of the wheelbarrow. It is evident that when the handles are pulled back, as in going downhill, the brake will be caused to press against the wheel. As soon as level or uphill ground is reached, the handles are pushed ahead and the brake is taken off. The lower handles have only the amount of slide necessary, the triangular pieces beside the rear links stopping the forward push of the handles and the brake stopping the backward pull. If more leverage is desired, so that the brake will press the wheel harder, simply place the pivots in the brake arms nearer the brake shoes. —F. E. Brimmer, Dalton, N. Y.

¶Tacks with large rubber heads, procurable at about five cents a dozen, make good insulators for electrical-instrument bases, one being put into each corner.

Lubricating Driving Chains with Graphite and Tallow

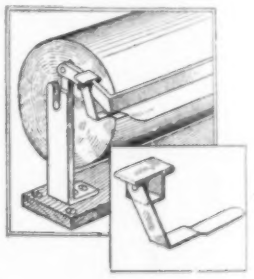
A few teaspoonfuls of flake graphite stirred into melted tallow or paraffin makes an excellent lubricant for exposed silent-chain drives. In addition to eliminating wear, this lubricant does not collect dust and dirt. It is very effective as a spring lubricant, staying in place well, and wearing longer than oils or greases ordinarily used for lubricating this kind of chains.

Running a Sewing Machine Backward

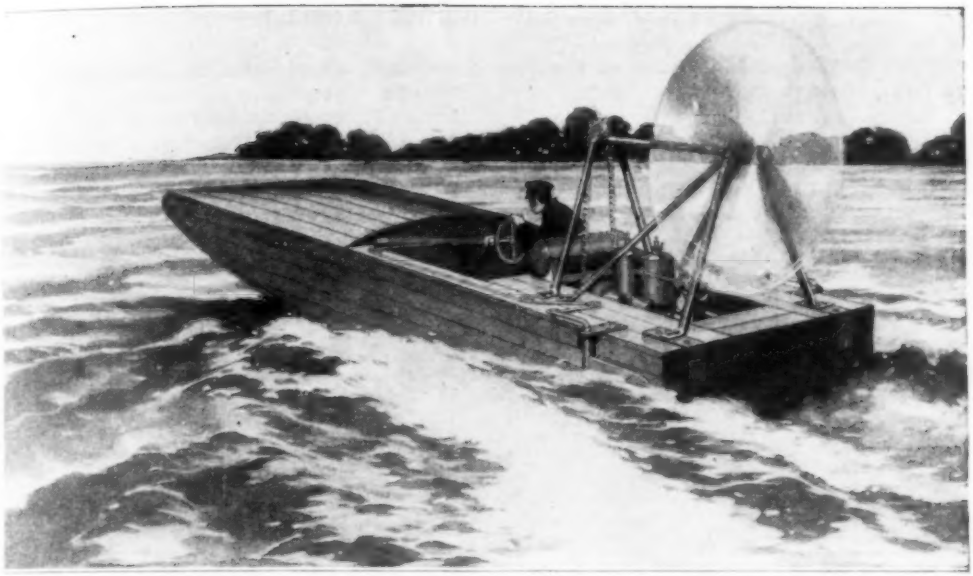
It is a great convenience to be able to backstitch with the sewing machine while finishing the ends of the hems in napkins, dish towels, or other small articles. Most machines, however, will only break the thread and not stitch when run backward. By raising the presser foot slightly, and starting the flywheel in the reverse direction, some machines can be made to backstitch nicely. It will be necessary to experiment somewhat before the proper height for the presser foot can be ascertained.—Winnifred K. Stabler, Olympia, Wash.

Finger Aids in Removing Paper from Roll

Much time is wasted in stores using roll wrapping paper, because of the tendency of the paper to adhere closely to the roll, making it hard to get hold of easily. The metal finger shown in the sketch holds the end of the paper away from the roll at all times, thus making it easy to grasp.



Three parts, cut from sheet metal, make up the attachment. The finger is bent as shown, and should be filed to a fairly sharp edge where it touches the paper roll. It is riveted to a U-shaped piece, which fits under the arm that carries the paper-cutting bar. The third piece is a cap that slips over the projections on the U-shaped piece and holds the attachment on the arm. As long as the finger is in place, it holds the end of the paper away from the roll so that it is easily grasped.—W. A. Saul, Lexington, Mass.



The Air-Propelled Hydroplane Moves Gracefully and Speedily over the Shallow Waters of the Small Lake or the Beach, Where Ordinary Craft might Find It Hard Going on Account of Danger of the Propeller Striking Bottom

Building an Air-Propelled Hydroplane

By F. D. BURKE

NEXT month Mr. Burke, who is an aeronautical designer of wide experience, will describe the building of an air-propelled speedster, or "wind wagon." As in the present article, the materials called for are such as are easily procurable at a low cost, and the design is worked out with a view to the greatest possible simplicity.—Editor.

THE high efficiency of modern air propellers has led to their adoption on land vehicles and boats which are not intended to rise from the surface. The great advantage of the air propeller for a boat is that it enables the craft to travel on very shallow water. In fact, the faster such a boat travels, the less depth of water it "draws."

The little craft here described is of the stepless type of hydroplane. The hull is of wood, 12 ft. in length, and 40 in. in width, or beam. The engine recommended is a light four-cylinder one, of 18 to 22 hp. The framework supporting the propeller and transmission is of steel tubing. With a motor of the type specified, the boat should develop a speed of 25 to 30 miles per hour; a twin-cylinder motorcycle engine may also be used with it, but the speed to be obtained with the smaller engine will, of course, be proportionately lower. The material, a list of which is given below, need not cost more than $80, including the propeller, but not including the engine.

Operating the Hydroplane

In operating a boat of this type, the builder will find that when it is fully loaded and at rest, the stern will rest much deeper in the water than the forward end. As the boat acquires speed, it will gradually come to a level running position. This is due to the fact that the thrust from the propeller is some distance above the boat, and tends to raise the stern and lower the bow. If, owing to any error in construction, the bow of the boat does not stand well up out of the water when at rest, great care must be taken when first operating the boat, that the propeller thrust does not force the bow to "nose down" into the water.

When running at good speed, it will be found that very little of the rudder is immersed. In turning, however, the boat will tip inward slightly, thus increasing the hold which the rudder has in the water. This "heeling" may be aided, when necessary, by the operator leaning toward the side to which he wishes to turn. No attempt should be made to carry more than two persons in the boat, and the possibility of carrying more than one will depend largely on the weight of the persons. Caution should be used at first, until the operator gets the swing of the boat's motion and becomes acquainted with its control. He will then begin to appreciate the freedom of movement possessed by a boat which requires but a few inches of water, and whose propeller does

not get tangled in the weeds of the lake or river bottom.

Hull

The framework consists of 16 transverse members, spaced equidistant, and tied together by spruce and ash longitudinals. These transverse members are numbered,

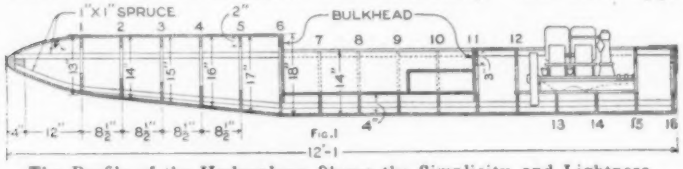


Fig. 1

The Profile of the Hydroplane Shows the Simplicity and Lightness Attainable in This Type of Boat

in Fig. 1, from 1 to 16. Those at the rear should be made first. Nos. 12 to 15, inclusive, are cut to the dimensions given in the lower view, Fig. 2. They are made up of pieces of ½-in. spruce, and should be assembled as shown in Fig. 2. The corners of the spruce pieces are fastened together by steel straps. There are two of these to each corner of the transverse members, one on each side of the joint. They should be riveted together with hollow copper rivets, or with light nails clinched over, if rivets are not obtainable. No. 6 is made to the dimensions given in the left upper detail; it consists of a framework of ½-in. spruce, with the addition of a solid piece of spruce, transforming it into a bulkhead. Nos. 11 and 16 are similar, except that the upper member of the frame, 3 in. wide, runs straight across, instead of being sawed to a curve. No. 11 forms a second bulkhead, while No. 16 is the rear end of the hull. Cut the solid pieces for these three members from the 5/16-in., five-ply veneer, to the outside dimensions given for the three members. The spruce frame pieces are then placed on the veneer, with their outside edges flush with the edges of the veneer. They are fastened in place with wood screws. Nos. 7 to 10 are made to the form and dimensions given to the right, in Fig. 2, and are of ½-in. spruce stock. Nos. 1 to 5 are made similar to No. 6, but they are of different depths, as dimensioned in Fig. 1.

The spruce bow piece is made up of two 2 by 4-in. pieces, shaped as shown in the detail in Fig. 2, and bolted together. The longitudinals are set into it and screwed down, as shown, and the keel and stringer pieces are similarly attached.

Hull Assembly

Before the frame assembly is begun, two of the 1 by 1-in. by 13-ft. spruce longitudinals should be steamed and bent around blocks which have been nailed to the floor, or to a plank, so as to give the wood the necessary curve. They should be allowed to dry on the bending form for two or three days; when taken off, they will hold approximately the right shape. They can be easily sprung into place on assembly.

The two top longitudinals are first put into place, and are attached to the transverse members by 1½-in., No. 4 wood screws, as shown in Fig. 2. For attaching to the bow piece, 2-in. screws will be preferable. The bottom longitudinals are next assembled, working forward from the rear of the hull, the curved ends being fastened last. In springing these ends into place, care must be taken to keep the top longitudinals straight, the lower ones being curved up to meet them.

The light stringer pieces, to which the planking is screwed, are next put in. They are of ¼ by 1-in. ash, and run the entire length of the hull. They should be set into each of the transverse members, and fastened with a 5/8-in., No. 3 wood screw. They must be spaced so that the

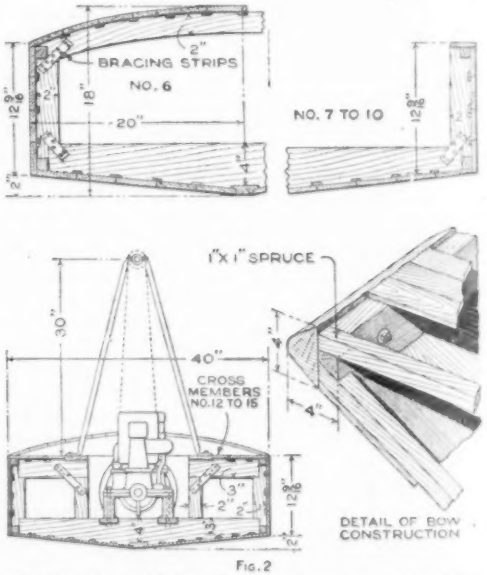
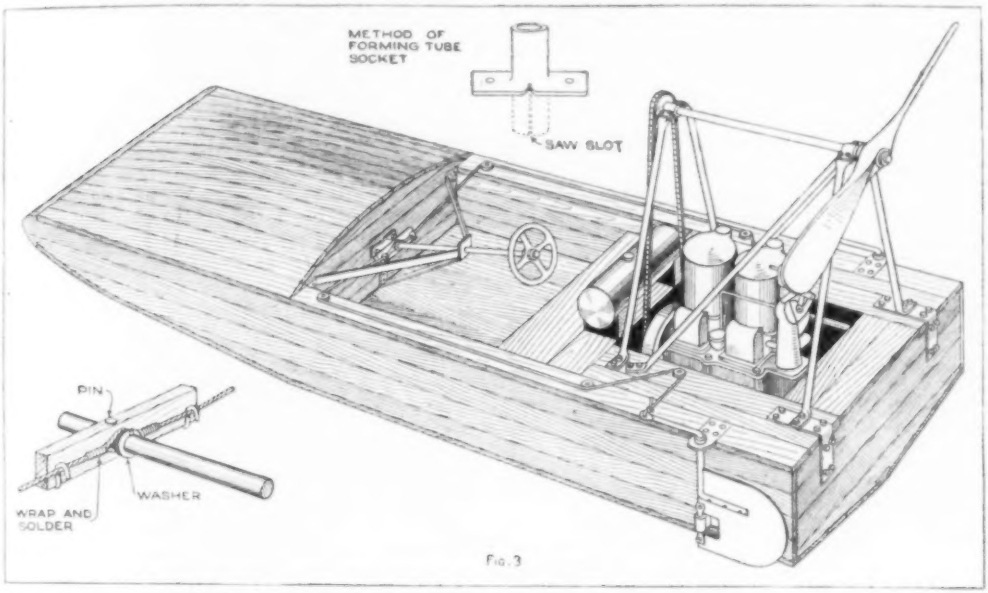


Fig. 2

Details of the Hull: The Construction of the Cross Members Determines the Shape of the Various Parts of the Boat

distance between centers is the same as the width of the planking, plus an allowance of 1/16 in. for clearance. The keel, of 1 by 1½-in. ash, should also be steamed

and bent over the same form as the spruce longitudinals. It is fastened into place which might take place later. The rest of the side and bottom planking is put on,



Assembly of the Hydroplane: Steering Is by Means of Two Rudders Controlled by an Automobile Steering Wheel. The Chain Drive Permits the Use of Sprockets Which will Give the Best Running Speed for the Propeller Used

by a 1½-in., No. 4 wood screw, where it joins each of the transverse members.

Engine Bed

The members of the engine bed, or bearers, are of ash, and are assembled as shown in Fig. 2, and fastened to the bottom cross members, as shown. The size and distance apart will depend on the dimensions of the engine to be used.

Planking the Hull

The hull is now ready to plank. The 5/16 by 3-in. cedar is used to plank the bottom; the sides and deck are ¼ by 3-in. cedar. Plank the sides of the hull first. A thin coat of marine glue should be given the side of the upper longitudinals, and the first stringer piece below it. A strip of unbleached muslin, 1 in. wide, is laid in the glue. Both edges of the first plank are given a thin coat of this glue; a plank is then placed against the side of the hull, with its upper edge flush with the top edge of the longitudinals. The edge of the plank should come about 1/32 in. from the center of the first stringer piece. The plank is then fastened on with ½-in., No. 2 wood screws, placed about 2 in. apart, in each cross member. In placing the second plank, a space of 1/16 in. should be left between it and the first one. This is to allow for any swelling of the planks as just described. The top is left open until later.

Steering Gear

Two pieces of ⅛ by ½-in. strap iron are bent as shown in Fig. 3, and then riveted to a piece of No. 12 gauge sheet steel, to form a tripod. This is bolted to the bulkhead with ¼-in. bolts. A large washer should be made of No. 12 gauge sheet steel to take the bolt heads on the forward side of the bulkhead. The steering column is a piece of tubing of the length that will bring the steering wheel to the position desired; its diameter will be governed by the size of the hole in the wheel used. An old automobile steering wheel will do for this purpose very nicely. The end of the tube fits into a tubing socket bolted to the bulkhead, as shown. The rudder bar is of ash, and is slipped onto the tube and fastened with a pin through it.

The rudders are of No. 16 gauge sheet steel, 10 by 12 in., riveted to a ½-in. steel rod, which is flattened where it is fastened to the rudder blade. The hinges are of No. 12 gauge sheet steel, and should be fastened at the point on the hull just opposite transverse member No. 14. From each of the two rudders, a flexible steel cable, ⅛ in. in diameter, running through pulleys fastened to the deck, is spliced and soldered around the steering post.

The operation of the steering gear is clearly shown in Fig. 3. Turning the wheel to the left causes the hook at the left of the rudder bar to come in contact with the steel cable, which pulls the rudder on the left-hand side into action.

The entire inside of the hull should now receive one or two coats of good marine paint, and the forward deck should be planked. The inner surface of the deck

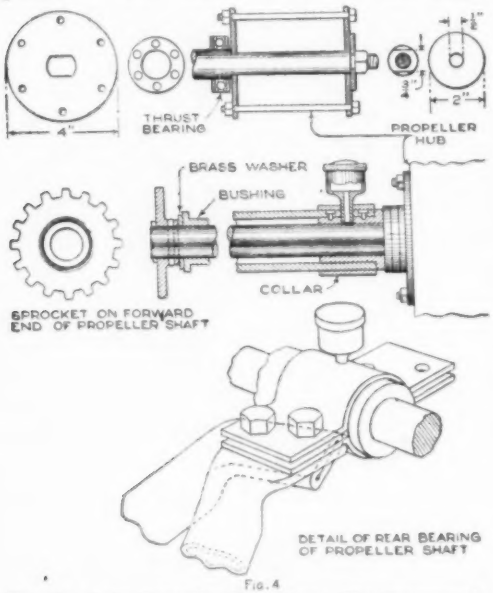


Fig. 4

Details of the Propeller Mounting: The Framework Is of Steel Tubing, in the Style Used in Airplane Construction to Produce Great Strength with Light Weight

planks should also be painted before being put on. The seat should be put in, as shown in Fig. 3.

Power Plant

The engine used should be of 18 to 22 hp., as stated above, if high speed is desired. It is not advisable to use a more powerful engine than this, as the craft might thus be overpowered and overweighted. An automobile engine is not likely to give very good service, although certain automobile engines, of 3¼-in. bore and under, might do very well if not worked too long at high speed. Motorcycle engines of the large sizes now being manufactured and rated at from 9 to 13 hp. will also drive the boat, but cannot be expected to give as good service as a marine motor with thorough water cooling. The engine should be provided with a sprocket, and a drive chain of suitable size and length. If the engine is of the motorcycle type, then it will be safe to use a motorcycle chain, but if a more powerful engine is used, a chain and sprockets must be provided which are capable of transmitting the full power of the engine.

The ash strips, 1 by 6 by 42 in., to which the propeller stand is bolted, are screwed into place on the rear deck, as shown in Fig. 3. To house the propeller shaft, a piece of No. 12 gauge tubing, 1½ in. outside diameter, 2 ft. long, has a plain bushing of antifriction metal forced into each end. The inside diameter of these bushings should be 1 in. Such bushings can be picked up in almost any repair shop. Sheet-metal collars are fitted around each end of the tube. The four legs of the mounting are of 1-in., No. 12 gauge tubing, with ends flattened, bent, and bolted to the collars, as shown in Fig. 4. The tubes can be neatly flattened by heating the ends and crushing them together in a vise. Two other tubes, running down forward from the rear bearing, are put in to take the thrust of the propeller. The propeller shaft should be about 3 ft. long, and 1 in. in diameter. One end should be turned down to ½-in. diameter for a distance of ¾ in., and should then be threaded for a ½-in. nut. This should be a left-hand thread, with a nut tapped to correspond. If it is not practicable to cut such threads, a right-hand thread may be permissible, if a good, heavy, castellated nut is used with a stout cotter pin.

On the same end the shaft should have two flat surfaces, filed as shown. Two disks of ⅛-in. sheet steel should be made as shown in Fig. 4. A 2-in. washer of No. 12 gauge sheet steel fits over the threaded end of the shaft.

The propeller mounting should now be set up, and the propeller placed on the shaft and bolted between the two disks. The 2-in. washer is slipped on, and the large nut is drawn up snugly. A 1-in. thrust bearing should be placed on the shaft and pushed up against the propeller hub. The propeller shaft should then be pushed through the bearings, and a thin brass washer slipped on the forward end of the shaft. The driving sprocket selected should have a shoulder as shown, which should be forced up against the end of the forward bearing with the brass washer in between, and the shaft pushed in until the propeller hub is pressing firmly against the thrust bearing. The location of the driving sprocket should then be marked, and the propeller shaft taken out and drilled for a taper pin, or a keyway may be cut so that the sprocket will be locked in place. The whole propeller unit should now be assembled and set up on the rear

deck. The drive chains should be placed over the sprocket on the propeller shaft and around the driving sprocket on the engine shaft. The propeller stand should be moved forward or backward until the two sprockets line up properly. The stand should then be bolted in place. Two iron straps, bent over the rear edge as shown in Fig. 3, and fastened with screws, will strengthen the base of the rear legs against the pull due to the propeller thrust.

The rest of the rear-deck planking is now put on, and the gas tank is mounted, as shown. The hull should be given two or three coats of good spar varnish.

The Propeller

The propeller used with the 20-hp. engine will be about 5½ ft. long, and should revolve at a speed of about 1,500 r. p. m. A pitch of 4 ft. is recommended, in order to give the highest speed, although this will depend on the actual horsepower which the engine delivers. It is, of course, possible to make the propeller by hand, but the manufacture of propellers has now advanced to such a point that very satisfactory ones can be bought on the market at prices not at all exorbitant. A good propeller should be obtainable from any house handling this class of aeronautical supplies for about $20.

Before the engine is given its first run, the propeller must be tested for alinement. The propeller should be turned until one blade just grazes the end of a stick temporarily clamped to the propeller stand. The propeller should then be turned until the other blade is in line with the stick. If the propeller is properly alined, this blade will also just graze the stick. Should there be as much as ⅛-in. clearance between the point of the stick and the propeller blade, the three bolts opposite this blade should be loosened, while the three bolts on the same side of the blade that is out of line should be tightened. The propeller should then be tested again, and if found to be in line, the three loosened bolts should be tightened up and the test repeated.

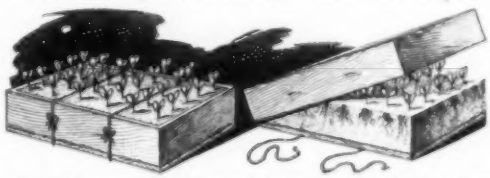
In starting the engine, retard the spark, open the throttle about halfway, stand on the rear deck and swing one of the propeller blades around quite rapidly. The engine should start after a few turns, if it is in good condition.

MATERIAL REQUIRED

4 pieces of spruce, 1 by 1 in. by 13 ft.
5 pieces of spruce, ¼ by 6 in. by 10 ft.
10 pieces of spruce, ½ by 6 in. by 10 ft.
2 pieces of spruce, 2 by 4 by 40 in.
2 pieces of spruce, 1 by 7 by 40 in.
1 piece of ash, 1 by 1½ in. by 13 ft.
20 pieces of ash, ¼ by 1 in. by 13 ft.
2 pieces of ash, 1 by 4 by 42 in.
2 pieces of ash, 1 by 6 by 42 in.
2 pieces of ash, 2 by 4 by 40 in.
14 pieces of cedar, 5/16 by 3 in. by 13 ft.
20 pieces of cedar, ¼ by 3 in. by 13 ft.
3 pieces of 5-ply wood veneer, 5/16 by 18 by 40 in.
24 ft. No. 12 gauge steel tubing, 1 in. outside diameter.
2 ft. No. 12 gauge steel tubing, 1½ in. outside diameter.
6 sq. ft. No. 16 gauge, cold-rolled sheet steel.
2 sq. ft. No. 12 gauge, cold-rolled sheet steel.
1 sq. ft. No. 10 gauge cold-rolled sheet steel.
8 ft. ⅛ by ½-in. strap iron.
1 steering wheel.
6 pulleys.
Wood screws, several sizes.
2 qt. marine glue.
3 or 4 yd. of heavy unbleached muslin.
2 gal. good spar varnish.
1 gal. good marine paint.
1 1-in. thrust bearing.
2 plain bearings, 1-in. inside diameter.

Seed Flat with Removable Sides

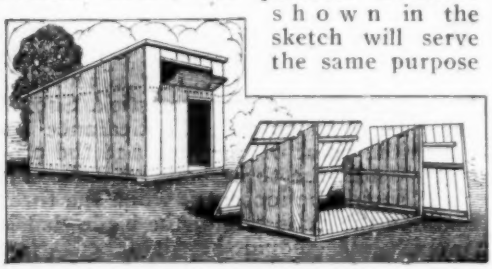
Seedlings are usually grown in wooden trays, or shallow boxes. When the plants are ready for removal, it is always rather a difficult matter to get them out without great root disturbance. A type of box that makes the matter quite easy is illustrated. It is only a few inches deep, and is fitted with a loose bottom. Strong twine is looped around its sides and bottom, and is tied above. Nails in the side of the box help to keep the twine in place. The seed flat is filled with soil in the usual manner, and the seed sown. When it is desired to move the small plants, the twine is cut or untied. The side of the box can then be easily lifted up, leaving the mass of soil with the seedlings intact. The baby plants are cut from this, with the earth clinging to their roots. Very little root disturbance is produced by this type of seed flat.—S. Leonard Bastin, Bournemouth, Eng.



Seedlings can be Removed from the Flat, Which Has a Loose Bottom, without Disturbing the Roots

A Portable Hog House

It is desirable to provide housing for hogs when they are turned into the fields after the harvest, or into newly cleared land. At such times, and at others when it would not be profitable to build a permanent house, the portable structure shown in the sketch will serve the same purpose



This Portable Hog House Provides Shelter for Animals Turned into Temporary Pastures, and can be Built at Small Expense

at little expense. It can be used elsewhere at short notice, since it can be knocked down very easily, and the parts transported from one place to another on an ordinary farm wagon.

The building is made in six parts, which fit together easily, and are then held in place by a few nails, or by hooks and staples. For ease in transporting, the building should not be more than 8 ft. square, and 7 ft. high at the front part of the roof. It should be made of 1-in. lumber, with 2 by 4-in. framing pieces. Although not absolutely necessary, it is now considered best to have floors in such buildings.

After the hog house has been set up, 2 by 4-in. pieces should be fastened across the building, about 1 ft. from the sides and 1 ft. above the floor. These serve the double purpose of bracing the structure and of protecting the smaller pigs from being crushed by the larger hogs. One advantage of such a building is that it may be stored in a very small space when not in use.—S. R. Winters, Washington, D. C.

Nail Set Kept in Hammer Handle

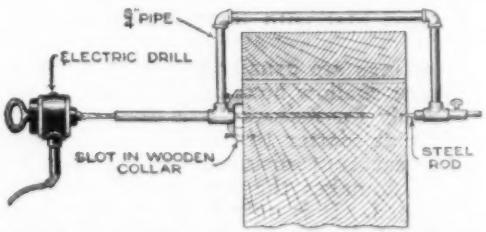
Since a nail set is always used in conjunction with a hammer, it is well to keep both of them together, and guard against the loss of the smaller article, which, because of its smallness, is often misplaced. This may be done by boring a recess in the center of the hammer handle for the deposit of the nail set. A small cork, or wooden plug, prevents its falling out.—Abel Green, New York, N. Y.

Removing Paint with Vinegar

After glass is set, the new putty is painted. If the work is not carefully done, paint is smeared on the glass. This may be removed with a cloth dipped in vinegar, or acetic acid. Brushes that have hardened paint on them can be softened by the use of vinegar or acid.—L. E. Fetter, Portsmouth, N. H.

Guide for Drilling Holes through Large Timbers

When boring holes through thick timbers, it often happens that the drill does not come out in the right spot on the opposite side of the timber. A guide made of pipe fittings will remedy the difficulty. Make up a ¾-in. pipe body for the guide, large enough to fit over the timber with several inches to spare. Screw a tee to each end. Into the tee which is on the side of the timber where the drill emerges, screw two short pieces of pipe, into which a length of sharpened steel rod can be slipped. Into the other tee screw a 20-in. length of pipe, and adjust the guide, by sighting and bending, so that this pipe is exactly in line with the steel rod at the other end of the guide. Make a wooden collar to fit loosely over the tee which has the long pipe in it. A hole or slot must be cut in one side of this collar, for the chips to fall through. To use the guide, drive the steel point into the spot from which the hole should emerge. Then, after slipping the wooden collar over the tee, slide the drill into the long pipe, and start the hole at the proper spot. The guide must be removed before the drill strikes the end of the steel rod. If the timber is thick, the hole can be bored first from one side, then from



By Using a Simple Guide, Holes may be Drilled Accurately through Large Timbers Such as Used in Bridges and Ships

the other, the guide being used both times. Since this guide can be made any size, it may be used in a great many cases, and should simplify the boring of long holes.—C. R. Simmons, Portland, Ore.

A Disappearing Cooling Chest

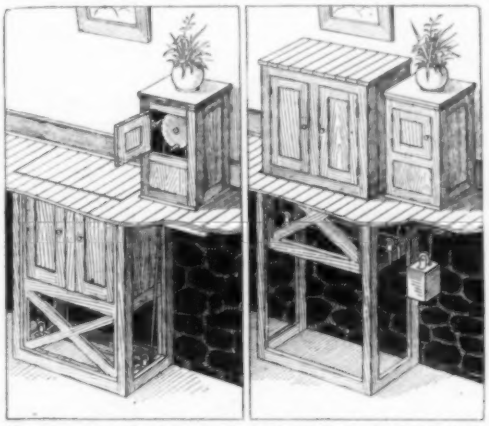
By VINCENT BROWNLEY

A FEW hours spent in building a sort of dumb-waiter chest, or cupboard, similar to the one shown in the sketch, will not only save many weary steps, but will improve the quality of the summer food. Since it must be made to fit into the place where it is to be used, only a general description, without dimensions, will be given. It may be adapted to the needs of stores and restaurants, as well as of private homes.

The cupboard should be quite strong, as its top, when in the lower position, is to serve as part of the floor. This top should be made to resemble the rest of the flooring as nearly as possible. A heavy base is provided for the cupboard to rest upon when lowered into the cellar; this base fits snugly into guides attached to posts extending from the basement floor to the joists of the floor above.

In order to hoist the heavy cupboard easily, a system of pulleys and a counterweight will be necessary. The rope is tied into a heavy U-bolt, or staple, in one of the joists, on the side of the cupboard opposite the counterweight. From the eye it is carried down to the base, under two pulleys, up and once around the hoisting drum, then down to the pulley from which the counterweight is suspended, and finally to another eye or staple in the floor joist. The counterweight may be a block of concrete, or a barrel or keg filled with stones of almost sufficient weight to balance the cupboard.

The hoisting drum is a pulley or sheave, made up of two 12-in. disks of 1-in. wood with beveled edges, nailed together so that these bevels form a groove. To one side of the sheave is fastened a disk of sheet iron, into which teeth have been cut with a hacksaw. The center hole is fitted with a bushing of brass tubing, and the assembled wheel or drum revolves on a ½-in. lag bolt. For a crank, or handle, a short piece of pipe on a bolt is placed at one edge of the ratchet disk. A small cabinet houses this mechanism, and may also serve as a flower pedestal or small table. Access to the crank is obtained by opening a small door built in the upper part of the case. The rope from the pulley on the base of the cupboard encircles the hoisting drum once, then drops to the pulley from which the counterweight is suspended. The friction caused by the rope on the drum, under the weight of the cupboard on the one side, and of the counterweight on the other side, keeps the rope from slipping. A small iron pawl, such as a bolt bent to shape, and filed at one end, fits into the teeth on the drum, making it possible to hold the cupboard at any point desired.

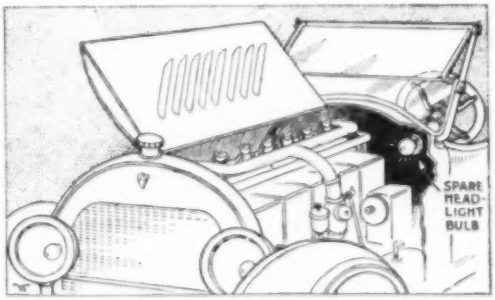


By Turning the Crank the Chest is Quickly Raised from the Cellar to the Kitchen Whenever Required

The cooling cupboard may be made any convenient size, and does away with a great deal of unnecessary stair climbing, keeping food in good condition at all times.

Spare Bulb for Auto Headlights Used under Hood

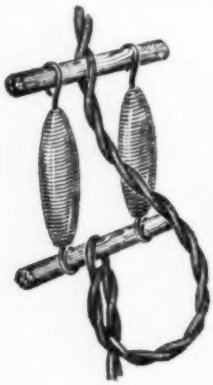
Every driver of an electrically lighted automobile should carry somewhere in the car a spare headlight bulb, as these may blow out at any time. Instead of carrying the spare bulb in a box under the seat, it is a good idea to mount a socket in the position shown, connecting it through a simple switch to the storage battery. The spare bulb thus forms a very convenient light for illuminating the engine, and the socket may also be found handy for attaching a trouble light.



The Spare Headlight Bulb Is Used to Illuminate the Space under the Hood When Work is being Done on the Engine

Shock Absorber for Electric Light

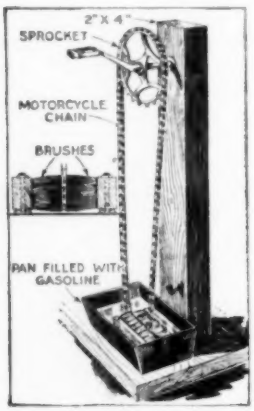
In factories or other places where heavy work is done on an floors, breakage of electric-light bulbs is an almost regular occurrence, due to the fact that the lamps receive heavy jars from the pounding of the machinery, or dropping of castings or other heavy articles upon the floor. This may be largely overcome by using a simple shock absorber upon each lamp. Two canary-cage springs, suspended between wooden rods, hold the heavy lamp and shade fixture in such a way that all the shock from the floor above is taken up by the springs. In this way, no jar is transmitted to the delicate lamp filament.—E. E. Hansen, New Britain, Conn.



Device for Cleaning and Oiling Motorcycle Drive Chains

The drive chains of a motorcycle are subject to more wear than any other part of the machine, because of the dust and grit the chain picks up, and because the owner frequently neglects to care for it.

A device for cleaning and lubricating chains is shown in the sketch. If used properly, it will not only lengthen the life of the chain, but will increase its efficiency.

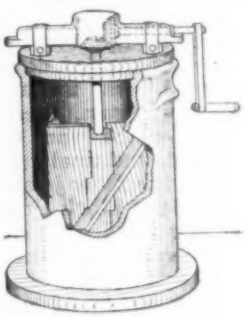


The device consists of an ordinary motorcycle drive sprocket mounted on an old bicycle crank, which in turn is set up on a piece of 2 by 4-in. timber, fastened to the top of the workbench. At the base of the upright is fastened a small bread pan with two stiff scrub brushes secured to the sides. To clean a chain, it is only necessary to remove it, and hang it over the sprocket. At the lower end, let one side of the chain pass around one end of the brush bristles, the other side coming up through them. Fill the pan with gasoline, and turn the crank. A few turns will be sufficient, unless the chain has gone without attention for a long time. When the chain is clean, wipe off the gasoline with a linen rag, and allow the chain to dry thoroughly. The proper stiffness of bristles and setting of the brushes will be readily discovered after a little experience in using this method.

To lubricate the chain, place it on the sprocket again, and run it through another pan in which a mixture of heavy oil and powdered graphite has been placed. When this has worked into the joints and under the rollers, the chain is ready for several hundred miles of travel.—John Edwin Hogg, Alhambra, Calif.

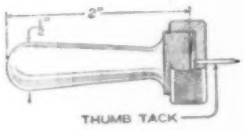
Churn with Ice-Cream Freezer Gearing

An old dasher churn was brought up to date by transferring an ice-cream freezer gearing to the 3-gal. earthenware churn jar. A wooden cover, in two parts, and also a wooden agitator, were made to fit the jar. The gears of an old ice-cream freezer were utilized for turning the dasher and were found to be just the thing when properly mounted. The freezer gearing, with gear case, was mounted on top of the cover, a block of wood being placed under each end of the case, as shown. The blocks were screwed to the cover, and bands of metal used to fasten the gear in place. The smaller gear was fitted with a rod, ½ in. in diameter, reaching nearly to the bottom of the churn. Another bearing was made for this rod by screwing a small metal plate to the bottom of the cover. The dasher was made from a rectangular piece of wood, 1½ by 1½ by 6 in., by boring a hole lengthwise to take the rod, and adding four paddles to the sides, so as to make about the angle shown. They were nailed into grooves cut into the central shaft. The rod was made removable from the small gear, so that these parts could be quickly removed, and used on the freezer when desired, in this way securing double service from the latter.—James P. Lewis, Golden, Colo.



Tool for Sharpening Thumb Tacks

Many draftsmen like the points of the thumb tacks they use to be very sharp, and are therefore not satisfied with those on the market. A convenient little device for use in sharpening thumb tacks is shown in the diagram. It can be turned from either brass or steel stock. The surface should be given a good polish, and the screw cap made to fit as accurately as possible, so that the tack point will be held rigidly while it is being sharpened with a small pocket abrasive stone. Tacks thus treated can aid materially in saving the draftsman's time.—F. H. Sweet, Waynesboro, Va.

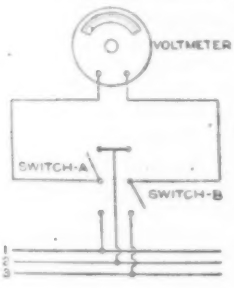


Removing Steel Screws from Brass

Pieces of brass, nickel, or copper, in which steel screws, tacks, or drills have been broken off, should be left in a saturated solution of alum, or a diluted solution of sulphuric acid. The steel will be dissolved and the brass or nickel will not be acted upon. A similar process is useful in removing steel screws from gold spectacles when they are too tight to be removed mechanically.—H. S. Hart, Shreveport, La.

Connection for Reading Voltage of Three-Phase Circuit

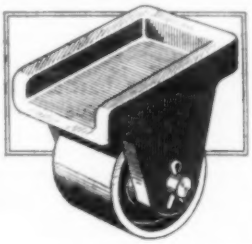
The sketch shows a handy method of connecting a voltmeter for reading phase voltages of a three-phase line, by the use of two single-pole double-throw switches. The arrangement is accident and fool-proof. With switch A thrown in the upper direction, and switch B in the lower, the voltage will be that between wires 2 and 3; with both switches down, the voltage read is between 1 and 3; and with switch A down and switch B up, the voltage is between wires 1 and 2. When both of the switches are up, the voltmeter does not register.—Peter J. M. Clute, Schenectady, N. Y.



Emery Stick Useful at Forge

A stick around which a sheet of emery cloth or paper has been tacked will be found useful in the forge shop. It is sometimes more convenient than a file for cleaning the surface after hardening, so that the deeper colors may be plainly seen. The advantage of tacking a whole sheet on at once, forming several layers, is that as one layer wears smooth, it can be removed, exposing the next one for use.

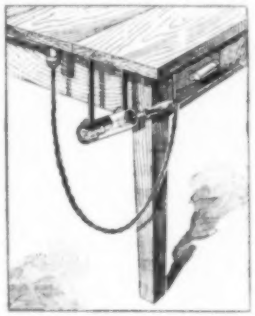
Moving Heavy Machines on Casters



Heavy casters, such as illustrated, can be placed very handily under the legs of machine tools which must be moved from one place to another over the floor of the shop.

Protecting the Tips of Electric Soldering Irons

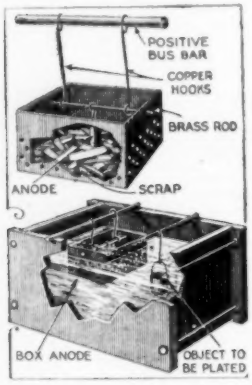
It is not difficult to prevent electric soldering iron tips, that are kept heated for long periods, from oxidizing and hardening. Make a cup to hold sufficient solder to cover the tinned portion of the copper, and fasten it in the holder, as shown in the sketch. The solder in the cup melts and prevents the air from reaching the point, thus keeping it always "tinned" and bright. The holder should be mounted at an angle under the bench, as shown, so that the handle of the iron may be grasped quickly and easily.—Alpha Dean, Chicago, Ill.



¶ To save time in making working drawings, omit one side of the arrow heads on dimension lines.

Scrap Metal Forms Satisfactory Anodes for Plating

Cast anodes for use in electroplating are expensive, and at times difficult to secure. An excellent substitute is obtained by using scrap anode metal, contained in a wooden box suspended in the plating bath. Special boxes may be made to suit the requirements of the tank or the workman, but for most purposes the following dimensions will suffice. Construct a box, 12 in. wide, 18 in. long, and 10 in. high, open at the top. Bore in the sides and bottom as many ½-in. holes as possible, care being taken to see that the wood does not split. A brass or copper bar, 20 in. long, passes from one end of the box to the other, and through holes in the ends drilled for the purpose. The diameter of this rod should be not less than ½ in. The box is then suspended in the plating tank and the rod electrically connected to the positive bus bar by copper hooks. The box should hang high enough so that the brass bar in it is not in contact with the plating solution. The box is now ready for the scrap metal.



If, for instance, zincplating is to be done, a small zinc rod is hung from the metal crossbar, and the box is half filled with pieces of zinc scrap, as shown in the sketch. These pieces may be old plates, or discarded portions of zinc anodes. Since the scrap pieces make electrical contact with the small zinc rod and with each other, the result is similar to that of one large anode, the holes in the box allowing free passage of the electric current from the metal to the electrolyte.

This box anode may be used with excellent results in nickelplating. It is impossible to obtain pure nickel anodes in the form of castings, since a certain amount of impurities, such as iron, are always present. Impurities impair the quality of plating. Pure nickel can, however, be obtained in the form of pellets. If these are used in the anode box, perfect plating may be accomplished. A coat of pure nickel will last much longer, and may be given a higher polish than an inferior plate containing traces of other metals. — Kenneth Coggeshall, Webster Groves, Mo.

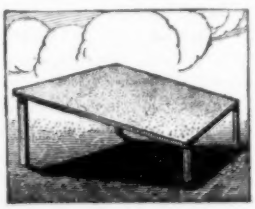
Potatoes Gathered While Vines Are Still Green

Some interesting experiments were carried out last season in connection with potato growing. Instead of waiting until the plants were matured, part of the crop was gathered when the plants had reached a fair size, the largest tubers that could be found being grubbed up from the soil. This operation was repeated a month later, and then the plants were allowed to mature in the usual manner. The last crop was quite up to the average in spite of the fact that two gatherings had been made during the growing season.

Most growers must have noticed, when they dig their potatoes, that there are always a number of small ones, about the size of marbles, or even smaller. But if some of the larger potatoes are removed during the growing season, these little ones develop into a good size. On the other hand, if the plants have already developed a fair proportion of large tubers, and these are still attached to the roots, the immature ones do not increase much in size. The soil disturbance which accompanies the removal of the potatoes positively benefits the plants. After each operation they start away with a fresh vigor of growth. This is probably due to the fact that the grubbing about in the ground helps aerate the soil.

Shelter Roofs for Poultry

Poultry, chickens, ducks, or geese, will not thrive during the summer months when there is no shade to protect the fowls from the great heat, especially about midday. In the case of young chicks, particularly, heat and rainstorms are very destructive. The shelter roof, an example of which is shown in the drawing, can be made very quickly, and may be shifted at a moment's notice to the particular range where it will be most useful.



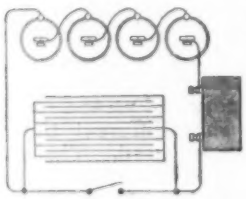
A frame for the roof can be made from 1 by 4-in., or other obtainable, boards. It is covered with canvas, prepared roof-

ing, or anything that will shed water. The size depends partly on the number of fowls in the flock, but about 6 ft. square is the largest roof that can be handled easily. A roof of this size will accommodate 10 to 15 fowls. If used for a larger flock, the shelter may be made in sections, each 6 ft. square, the completed roof being 6 ft. wide, and as long as necessary.

The shelter consists of this roof, supported on stakes driven into the ground. It need not be more than 1 ft. from the ground to the roof, at the lower edge, and just enough higher at the front to give it the proper slant for shedding rain. The usual method is to place such a shelter from 5 to 10 yd. from each colony house.

Testing Ignition Condensers

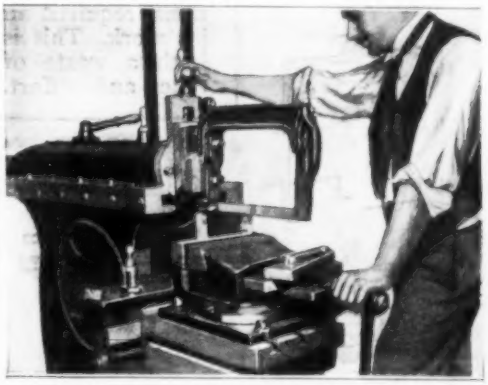
When a gasoline engine begins to miss on first one cylinder and then another, when a feeble red spark appears at the plug, when the breaker points burn quickly, and when a large amount of sparking can be seen at the breaker points while the engine is running, the chances are that the condenser is not working properly. It can be tested with the ordinary shop equipment, if wired up as shown in the sketch. The current is supplied by four to six dry cells. An ignition coil is placed in the circuit, just as used with the engine. The condenser is connected across the spark gap, with the battery in series, and the wire ends are touched together and then separated. This should be repeated with and without the condenser, using a switch to throw it into circuit, and the spark caused by separation of the ends of the wire noted in each case. If a good condenser is being tested, practically no spark will result. If a poor condenser is under test, or none at all is in the circuit, a large spark will be caused by separating the wires. It should be remembered that loose condenser connections will often give the same results as a poor condenser.—S. E. Gibbs, Urbana, Ill.



¶Ropes holding camp tents in place should be loosened at night, or moisture may cause them to contract and pull out the stakes, resulting in a wrecked tent if the weather is windy.

Shaper Used as a Hacksaw

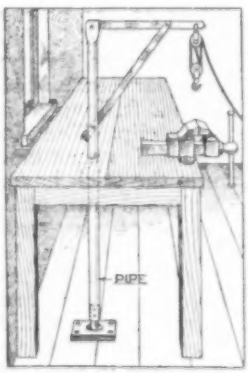
The usefulness of an ordinary shaper for sawing is particularly apparent when slanting cuts are to be made; by swiveling the vise, the saw can be set to cut at any desired angle. Certain cuts can be made in heavy castings, which could not be held in the ordinary power hacksaw, and a short stroke, possible with the shaper, is often an added advantage for this kind of work.—J. J. McIntyre, Bridgeport, Connecticut.



The Usefulness of the Shaper is Enlarged by Providing It with a Hacksaw Frame

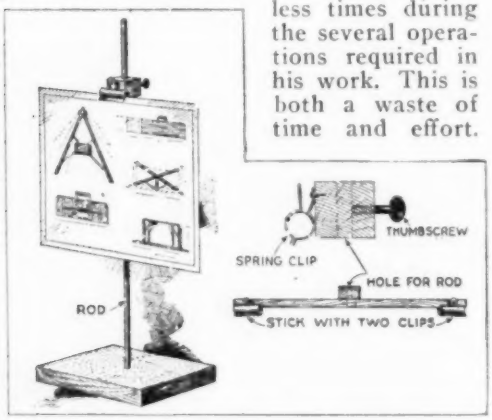
A Bench Hoist or Crane

A simple hoisting rig, or bench crane, is easily made of iron pipe, and two pieces of iron bar. One piece of pipe is used for the column, or upright, and its top end is flattened for a length of about 2 in. A diagonal slot is drilled and filed in the pipe 1½ ft. below the top, for the brace, which is bolted to the pipe and to the iron boom. The lower end of the pipe has a piece of round stock riveted into it, and the lower end of this piece is made ball-shaped to act as a pivot. A block of wood, with a dished iron plate secured to it, is used under the foot of the crane as a bearing. The pipe passes through the bench, which helps support it.—C. H. Willey, Concord, N. H.



Blueprint Holder for Machinists

A machinist often has to turn to a blueprint from the bench or machine countless times during the several operations required in his work. This is both a waste of time and effort.



A Blueprint Holder near the Machine Helps a Machinist to Do Accurate Work with the Least Effort

The blueprint holder shown in the sketch will hold the print constantly before him so he can read it while standing naturally at his machine. It is easily made from odds and ends to be picked up about the shop.

Mount a piece of 3/16 or 1/4-in. round iron rod, about 3 in. long, vertically in a block of hard, heavy wood, sufficiently large to support it steadily, by first drilling a hole in the block slightly smaller than the rod, and then threading one end of the rod into it. Next, cut a block, about 2 in. square, out of hard wood, and drill a hole through its center, slightly larger than the rod. Then, through one side, at right angles to the hole, insert a thumbscrew, and opposite it fasten a strong spring paper clip of the type shown. Turn out a similar block, but screw a stout stick about 2 ft. long to it, each end bearing a spring clip. The block bearing the single clip will accommodate small sketches, while the stick having two clips on it can be slipped into place when larger drawings are to be read. By means of the thumbscrew, the blocks can be raised or lowered upon the rod to the desired height, and held firmly in place. If it is desired to secure the stand upon the machine upon which the work is to be done, tap a hole in the machine bed, into which the threaded end of the rod may be screwed.—L. B. Robbins, Harwich, Mass.

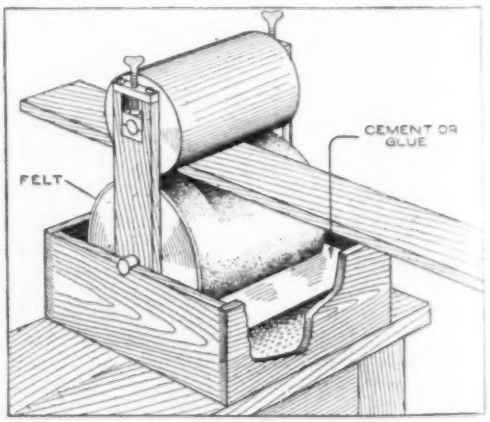
A hacksaw blade can be fitted into a frame which is too long for it, by bending a long nail so as to hook into the hole of the blade and fasten it to the handle end.

Feeding Liquid Fertilizers

It is always a difficult matter to make sure that liquid fertilizers fed to a plant really reach the roots. Much of the solution is lost because it spreads over a wide area of the top soil. This trouble is avoided by the simple method of sinking an ordinary flowerpot close to the stem of the plant. It should be plunged in right up to the rim, in such position that the hole at the lower part is nearly in contact with the roots. When it is desired to apply the fertilizer, the solution is simply poured into the pot, and allowed to soak away slowly through the hole. Plants treated in this way show a marked improvement over those dealt with in the ordinary manner, which is really wasteful of the fertilizer.

Device Applies Glue or Cement to Long Boards

An easily constructed fixture, for applying glue or cement to one side only of long strips of wood, can be made as shown in the sketch. A small metal-lined container is made, with two uprights projecting in the center to form supporting bearings for two rollers. The lower roller is made of wood, with felt fastened to its outer surface; the upper roller is also of wood, but can be adjusted up and down in the uprights so that different thicknesses of board may be used. The adhesive substance is picked up by the lower roller and carried on the felt, so that a board running between the two rollers



One Side of a Long Strip is Covered Evenly with Glue by Passing It between the Rollers

will receive the cement on its underside as the lower roller rolls on it. At the

same time, the roller dips into the cement, which provides a sure supply to the boards as they are pushed through. As the two rollers do not touch when they are not in operation, no glue reaches the other side of the board. The upper roller supplies just sufficient pressure to squeeze the glue out of the felt as the board goes over the lower roller.

Perforated Pail Sprinkles Insect Powder

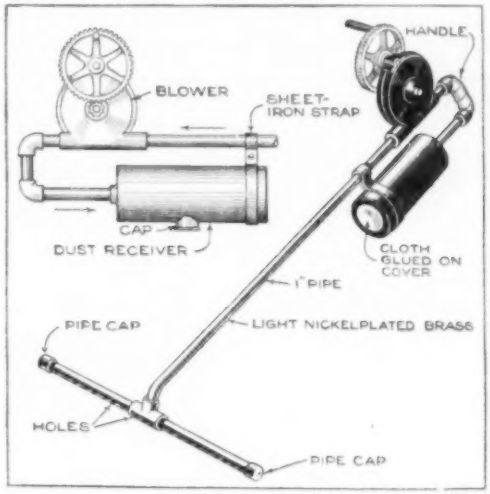
Florists or gardeners who have a large number of plants which must be sprinkled with "slug shot," or other insect powder, will find use for an ordinary tin pail with a lid, and with numerous small holes punched in the bottom. The pail makes the task of shaking the powder over the plants a light one.

To Recover a Lost Faucet Screw

It may happen sometimes that the machine screw from the underside of the valve stem in a faucet works loose, and drops down a straight length of water pipe. It may be recovered in this way: First shut off the water pressure, then remove the valve stem; plug up the inside of the spout with waste, and cover the upper open end of the faucet with a glass tumbler. Now, by having some one turn the water on and off quickly a few times with a fairly good pressure, the lost screw will be forced up the pipe and out through the top opening covered by the tumbler, thence falling into the basin, which should first be stopped at the outlet.—Fred Schimke, Hartford, Conn.

A Suction Carpet Cleaner

A blower such as used in small forges, some pipe and fittings, a tin can, and an iron strap are the materials used for making the suction cleaner illustrated. The size of the pipe to be used will be determined by the dimensions of the blower. The best kind of pipe to use is light brass plumbing-fixture pipe. The two pieces inserted in the tee at the bottom should be perforated with a number of small holes, large enough to receive the dust drawn in by the suction from the blower. Care must be taken to mount the blower in the proper direction so that it will force the air upward rather than downward. The dust catcher may be a tin can of suitable size, the cover of which should have a large hole made in it, covered with cloth glued around the edges. This permits

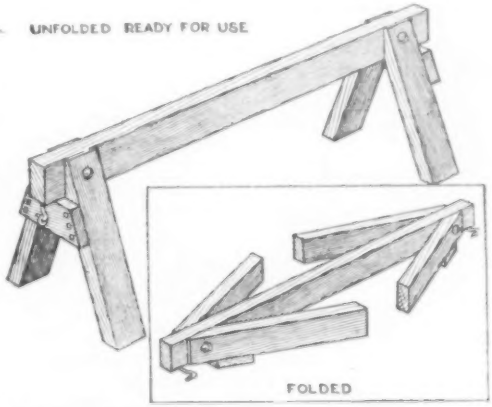


A Homemade Suction Cleaner Makes Use of a Hand Blower Such as Used on Light Forges

the air to escape after discharging its dust in the can.

A Folding Sawhorse

The sawhorse illustrated folds up flat, so that it can be stored in a small space. The thickness, when folded, is but little more than the width of the stock used in making the horse, which can, of course, be from 2 to 6 in. or more, depending on the size and strength desired. Screen-door hooks at each end keep the legs from

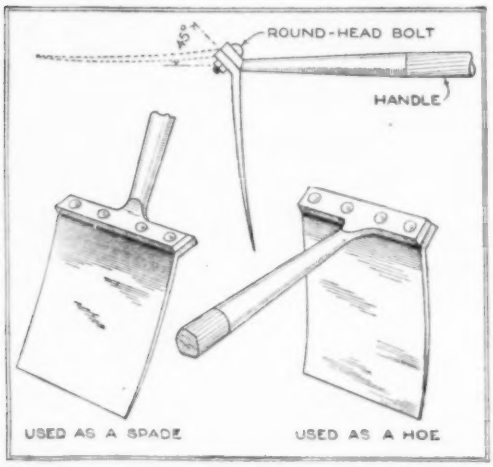


The Four Legs of the Sawhorse Fold Up on Unfastening the Two Hooks in the Ends

folding up while in use, and give rigidity to the sawhorse—C. A. Black, Jr., Hightstown, N. J.

A Combination Hoe and Spade

The illustration shows a tool which can be changed from a good strong hoe into an equally stiff spade by removing four

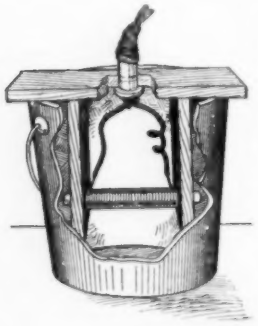


Removing the Four Bolts and Reversing the Blade Converts the Garden Spade into a Hoe

bolts and replacing them. In this way, the one tool will serve the purpose of both, especially when one of the tools is needed only occasionally.—Violet Johnson, Rockford, Ill.

Engine Oil Heated before Pouring

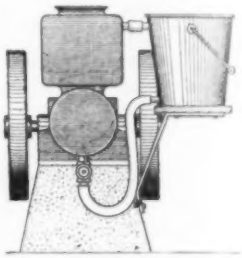
In cold weather, lubricating oil, especially that for air-cooled engines, becomes too thick to pour easily. Even when kept in a heated garage, the cement floor upon which the container usually rests is cold enough to keep the oil thick. The heater shown in the sketch will enable the motorcyclist or airman to pour the oil easily. A short piece of board rests across the top of the pail in which the oil is to be kept. To the underside of this board are nailed two short pieces extending nearly to the bottom of the pail. A 200-watt enameled resistance coil is slipped onto a long porcelain tube, which is supported about 3 in. above the bottom of the pail by the two wooden pieces. The terminals of this coil are connected to a lamp cord



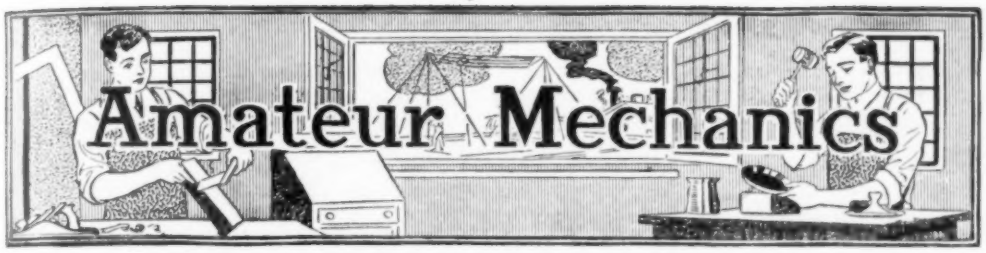
which is inserted through a piece of porcelain tube, knotted and wrapped with tape on the tube to keep it in place. It should be provided with a plug at the end, for connecting to the lighting circuit. The 200-watt coil will heat a pail of lubricant from 32° F. to 100° F. in about one-half hour. If the enameled heater coil cannot be easily obtained, a coil which will serve the purpose as well can be made by winding 12 ft. of No. 36 gauge nickel-silver ("German silver") wire upon the porcelain tube. Each turn must be spaced so as not to touch any other turn. Such a heater will be found very useful in a large garage.—J. G. Zimmerman, Milwaukee, Wis.

Hopper-Cooled Gas Engine Provided with Circulating System

When a hopper-cooled gas engine is run under heavy load for long periods, especially indoors, in the summer, it fails to give adequate cooling, and the water soon boils away. Since running the engine without water would soon ruin it, some one must be on hand to watch the water supply. A much better way, both from the standpoint of efficient cooling, and that of having to watch the engine, is to provide a circulating system. A large pail, or other receptacle, is provided with short lengths of pipe at both top and bottom. The hopper of the engine is also fitted with a short length of pipe at the top. The two pieces of pipe, one at the top of the pail, the other at the top of the hopper, are connected with a piece of rubber hose. Another piece of hose connects the drain cock on the engine with the pipe at the bottom of the pail. When the pail is filled with water, the drain cock opened, and the engine running, there is a continuous circulation of water which prevents the water from vaporizing so rapidly, and therefore the system does not have to be filled as often as if the hopper were used alone.



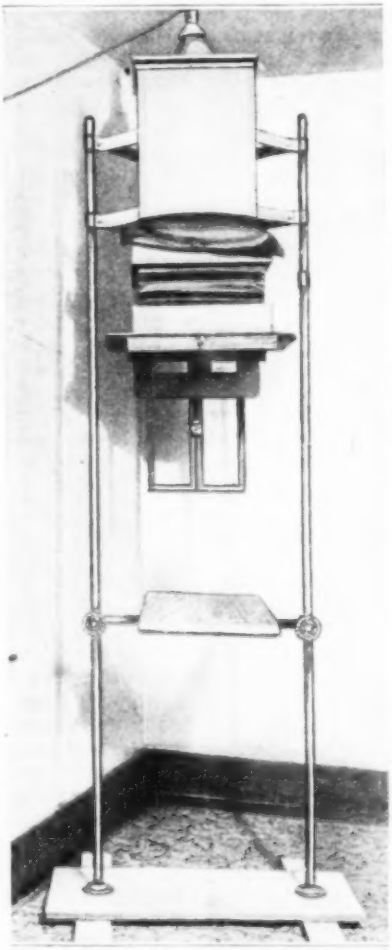
¶ Several yards of asbestos paper wrapped around the hot-water tank and bound with a steel wire will keep the water hot for use at night, and sometimes even in the early morning.



An Upright Enlarging Camera

By ARTHUR F. SMITH

WHERE a limited floor space in the dark room is available for an enlarging camera, an upright machine will be found the most practical. The type shown here can be operated like any printing box, while in a sitting posture. Its construction is simple, and the material used in its making are, with the exception of the electrical attachments, discarded parts of something else. It is made up of a few feet of old 1-in. pipe, some boards, nails, bolts, a bit of black cloth, two valve wheels, a piece of cardboard, an old pair of lenses, a bread board, a small auto-headlight reflector, an electric-lamp socket, and a few feet of cord.



An Upright Enlarging Camera Is Compact, Convenient in Use, and Easy to Make from Cheap Materials

The frame, or standard, consists of the two long pipes, which are set upright, and fastened at the base to the board platform by means of floor flanges. At the top of the standard are hung the light box and camera. These are fastened to the standard by four strips of galvanized iron, 1 in. in width, bent around the pipe and screwed at the ends to the corners of the box. Bolts are placed through the strips as near the pipe as possible. When these are tightened they hold the box in place, and when loosened, the box can be changed to a higher or lower position. In the top of the box the reflector is placed; if a long-necked nitrogen or argon-filled lamp is used, a cone or tube should be set above the reflector, to support the socket and keep the filament well to the back of the reflector. This can be made from tin, brass, or any material available. The inside of the box is given a coat of white paint, or silver enamel, such as used on steam radiators. At the bottom of the box is a slot where a cardboard frame is inserted, which holds the negative. A ground glass should be placed on the upper side of the negative plate; if a film is used, place it between a ground glass and a clear glass, with the ground glass on top. This distributes the rays of light more evenly over the negative. A piece of black cloth is tacked over the slot, and dropped down over it while the exposure is being made, to keep the light from escaping. At the bottom of the box the lenses are mounted. An ordinary camera can be used here, or lenses can be mounted permanently. If the latter arrangement is used, all that one needs to buy is a pair of secondhand lenses; the rest is merely a box with black-cloth sides, open at the light end. An opening only large enough to insert the lens is necessary at the lower end. This camera, or lens mounting, slides up and down on a frame or track, in order to get the correct focus. A thumbscrew or bolt is used to hold the

camera in place on the track. Several stiff wire squares can be put around the black cloth, and attached to it at the four corners; this will keep it from sagging in and cutting off the light while the "bellows" is relaxed.

Below the camera is the easel, made from a bread board attached to a piece of pipe by two wood screws through the pipe. The pipe is attached to the standard by two tees, larger than the long pipes, so that they will slide up and down freely. Through one side of each tee a hole is drilled and threaded, and in it works a stove bolt of the same size, which is soldered onto a valve wheel. When these setscrews are tightened against the upright pipes, they hold the easel at the proper elevation. As the printing paper lies flat on this table, no pins or thumb tacks are needed. The paper is held flat by laying a piece of glass on it. If a border is desired on pictures, pieces of glass varying in size can be masked and placed over the paper. To insure getting the paper in the same location each time, the board is laid off for different-sized pictures, and holes are made partly through the board where small pegs are placed to hold the paper and glass in position. Any number of pictures can be made from one negative without moving these pegs. When a different-size picture is to be made, the pins are set over in the other holes, and the paper and glass can be dropped into place quickly. These pegs can be made from matches or short nails with heads removed.

If a picture is desired that would be too large for the board to accommodate, place a mirror on the board at a 45° angle to the lens, and place the paper on a near-by wall.

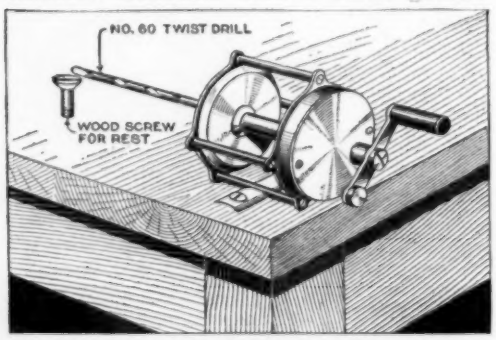
Developing trays for the large prints can be made at a very small expense. Wooden boxes, about 3 in. deep, are used, white oilcloth being tacked to the rim of the box, and pressed down inside. These will last a long time.

During the several hours usually required for drying large prints, they will often curl up. The drier used with this machine was made out of a 3-ft. length of furnace pipe. Several yards of corrugated paper were secured from a store, also as many yards of cheesecloth. The cloth and paper were basted together along the edges, and the pipe was rolled up in them, with the cloth on the outside. Place prints, face down, on the cloth, wrap some newspaper or wrapping paper and some string around the roll outside of the prints, and set the roll on end above a small oil stove. In a few minutes, the prints can be removed both dry and straight. This drier does not take up as much space as the ordinary racks, and a large number of prints can be handled in a very short time.

This entire finishing outfit was made at a very small cost, and any amateur should be able to secure and assemble the material used in its construction.

Fish-Rod Reel Forms Small Drill Press

While building a model airplane, an amateur mechanic used a small geared



A 40-Yard Multiplying Fishing Reel Makes a Cheap Drill Press for Small Work

drill press, made from a cheap 40-yd. multiplying fishing-rod reel. The oil cup was removed from the end opposite the crank, and a hole drilled in the end of the spool shaft with a No. 60 twist drill, to a depth of 3/8 in. Care was taken to get this hole exactly in the center of the shaft end, and parallel with the length of the shaft. The shank of the drill was then placed in this hole, and the soft brass of the shaft pricked with a center punch to hold the drill firmly in place. Each end of the reel tang was then drilled, so that it could be screwed firmly to the top of the workbench. A screw was sunk part way into the bench, upon which to rest the piece of wood while boring with the miniature drill press. Since the reel cost less than $1 in the first place, and was not harmed by the change made, the drill was economical as well as efficient.—Jack D. Bardill, Brooklyn, N. Y.

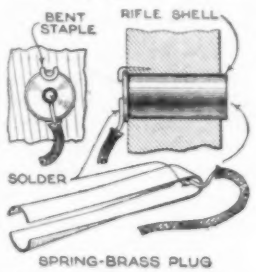
Cleaning Stained Marble

Marks on marble detract very much from its appearance. Many of these, owing to their greasy nature, will not yield to ordinary washing with soap and water. All stains may be easily removed

if the marble is washed with a weak solution of oxalic acid and water, about a teaspoonful to a pint. A stronger solution may be used in the case of very deep stains, but on no account must it be allowed to remain for more than a few minutes on the marble, or it will eat into the surface. The polish may be taken away by the cleaning process, but it can be rapidly restored by mixing powdered pumice stone and vinegar, and rubbing it on the surface. Leave it on for a short time, and then wash with plain water. Finally, wipe the marble quite dry and rub briskly with whiting, and a piece of chamois skin. A beautiful polish can be quickly secured by this method on any marble surface.

Cartridges Make Simple Switchboard

A switchboard of the plug-in type can be readily made by the amateur from a number of rifle cartridge shells of the same size. These are sawed off at the open end to a length slightly greater than the thickness of the plug board. Holes of the proper size are drilled in the board, the shells are inserted, and fastened by driving a staple beside each and bending it over, as shown. A wire soldered to the rear end of each cell provides the electrical connection to it. The plug used is made from a single strip of spring brass, by bending it to the shape indicated, and soldering the cord to the strip at the bend. Such a switchboard provides a very handy means of connecting any two of a large number of circuits.—F. H. Sweet, Waynesboro, Va.



Adhesive Plaster Makes Good Ends for Shoestrings

When the metal ends come off from shoestrings, it is not necessary to throw the string away or spend much time making new ends from pieces of metal. A quicker and very satisfactory way is to use a small piece of adhesive plaster, rolled around the end of the string, and heated slightly, if convenient, to insure that it will not come loose.—Henry E. Lynch, Montreal, Can.

Catching Poultry with a Net

It is almost impossible to catch one out of a flock of chickens by ordinary means without creating a commotion which has a bad effect on the flock and which is likely to disturb the neighbors. The poultry net shown in the photograph makes the process a much easier one. A ring, 15 in. in diameter, is formed from ⅜-in. iron rod and fastened to a long handle. A net of cheesecloth, or of the regular woven variety, is fastened to this ring. To catch the fowl it is only necessary to walk quietly among the flock until the fowl to be caught is singled out. A quick flop of the net catches the fowl without exciting the flock, as the usual prolonged chase would do.—Fred Telford, Chicago, Ill.

Fowls may be Caught without Disturbing the Flock by Using a Poultry Net

Seedlings Watched While Growing

In many schools, teachers show their pupils how a seed germinates and grows, as part of their nature study. One way in which this is done is to use a glass fruit jar, as shown in the photograph. The jar is first lined with blotting paper. The space inside the jar is then filled with sawdust. The seeds to be watched are placed between the blotting paper and the glass. By keeping the sawdust wet, the seeds germinate readily and can be examined through the glass at any stage of their growth. They should be kept in a warm, sunny place.

How to Make Double Exposures

It is not uncommon at moving-picture shows to see an actor play two different parts on the screen at the same

The Use of a Homemade Duplicator Makes It Possible to Take Pictures of a Man Playing Cards with Himself

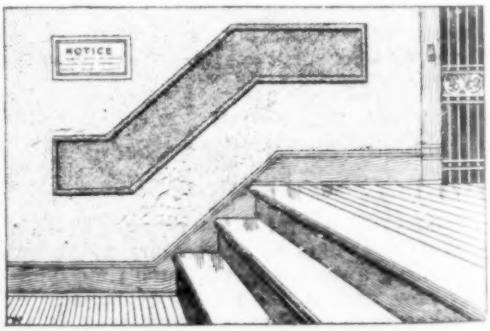
time. In spite of its seeming impossibility, almost any amateur photographer may make pictures of his friends playing games with themselves, as the old man in the photograph is doing, or even to have them shake hands with themselves. The trick is accomplished by what is called "double exposure," which means that two different pictures are taken on the same plate or section of film. The easiest way in which the amateur can take such pictures is to use a device called a duplicator, which can be made at home in a few minutes. If a film camera of the folding type is to be used, secure a small, round, pasteboard box, such as a pill box, just large enough to slip over the lens housing. Cut exactly half of the bottom from the box. To take the picture, set the camera on a solid base, and pose the person who is to do the acting on one side of a table, or other position, as selected. Then slip the duplicator over the lens, with the opening in the bottom of the pill box on the side of the lens opposite to that upon which the person is sitting. For example, if the sitter is on the right side of the table, the left side of the lens should be uncovered. Then make the normal exposure for the subject and distance, leaving the duplicator on the shutter. Then turn the duplicator so that the opposite side of the lens is covered, pose the sitter on the other side of the table, and take another picture without turning the film. If the work is properly done, the finished picture will show the sitter on both sides of the table, similar to the effect seen in the photograph printed here. Since the poses can be changed to suit the fancy of the photographer, there is no limit to the variety of pictures that may be made in this way. However, in taking such pictures as that of a man shaking hands with himself, it is extremely difficult to pose the picture so that the hands will meet exactly.

With a folding plate camera, the duplicator may be a piece of cardboard inserted in the back of the camera, between the bellows and the plate holder. It is used in the same way as the pill box.

Box cameras are used for double exposures by holding a piece of cardboard over half of the lens opening on the same side that the sitter is placed on. In any case, a great deal of amusement can be had by a careful camera owner, by asking people to pose for him in this way. It is also possible to pose different people on the same plate or film without their knowledge, much to their astonishment when the finished picture is seen.—S. R. Fass, Brooklyn, N. Y.

A Match Scratcher for the Shop Exit

Workmen, leaving the factory or shop at quitting time, almost invariably light a pipe or cigarette as they pass from the exit. While this gives them shelter from the wind, it also means that the walls near the door will be defaced by the striking of matches. A shop manager, realizing that he could not prevent this habit, had large strips of emery paper placed on the walls near the exits. These strips were approximately 18 in. wide and 10 ft. long, and were bordered by strips of varnished wood, as shown in the sketch. Needless to say, the workmen appreciated



A Factory Match-Scratcher Panel Prevents Employes from Defacing the Walls on Their Way Out

this convenience, and did all their match scratching on the emery cloth.—K. M. Coggeshall, Webster Groves, Mo.

Woodland Shelter House Built around Dead Tree Trunk

THERE is not much pleasure to be had in the woods if no shelter is near when rain threatens at any minute. Many picnics are broken up by showers which last but a few minutes, simply because there is no way to protect the food or to keep dry until the squall passes over. A shelter, such as illustrated, will take the discomfort out of walks and picnics, and will induce people to tempt the weather more often, since they know that protection is within easy reach.

A dead tree, the trunk of which is still quite sound, makes an excellent start for such a shelter. It should be cut off about 10 ft. from the ground, care being taken to make the saw cuts as even as possible. It may be necessary to erect scaffolding to make this cut properly. After the cut surface is worked smooth, eight rafters are fitted into the top of the trunk. The rafters are 12 ft. long, four of them being 2 by 4-in. timber, and four, 4 by 4-in. They are supported at the outer end by 4 by 4-in. posts, driven into the ground and extending 8 ft. above it. The 4 by 4-in. rafters should be fitted into the log first, the 2 by 4-in. being added later. Upon this framework, which forms an octagonal, umbrella-shaped structure, ⅞-in. boards are nailed to form the roof. This may be covered with shingles or some roofing material.

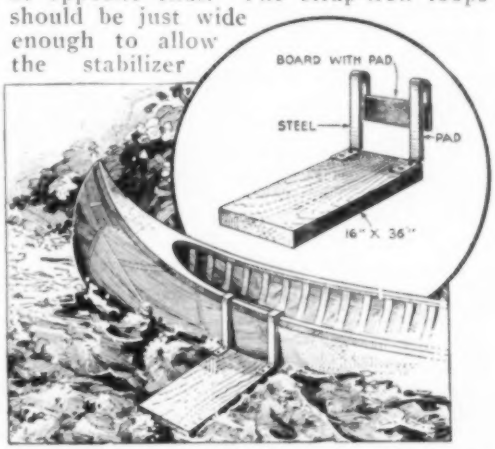
For greater comfort, a seat built around the trunk may be added, and other seats may be built near it. The whole

Picnickers Have Little Fear of Passing Rainstorms When a Substantial Shelter Is Near to Protect Clothing and Food

structure should be finished in a dark, neutral brown, with just a touch of white trimming. If the roof is stained a moss-green, the color scheme will be in harmony during all seasons of the year, with the prevailing colors throughout the surrounding woods.—G. L. Meller, Fargo, North Dakota.

Quickly Adjusted Canoe Stabilizer

Fishing from a canoe is dangerous at best. This is especially true when trying to land a fighting bass, or other game fish. For use at such times, and also for safety when caught out in rough weather, stabilizers such as shown in the drawing are almost invaluable. Two floats, which can be quickly put on or taken off the canoe, will secure the desired stability in any but the roughest weather. Each float consists of a board, 36 in. long, 16 in. wide, and 2 in. thick. Two strips of strap iron, 2 in. wide and 3/16 in. thick, are heated and bent as shown in the sketch. These are bolted to the board, and another narrow board, which is padded with canvas or corrugated rubber, is fastened inside the loops of the strap iron. Other pads are fastened to the straps themselves, to protect the canoe from the rubbing of the straps while the stabilizer is in use. While fishing, or when paddling across rough water, the two floats are placed over the edges of the canoe on opposite sides and at opposite ends. The strap-iron loops should be just wide enough to allow the stabilizer



Floats, Padded to Protect the Sides of the Canoe, Give Stability in Rough Water or While Fishing

to fit snugly to the gunwale of the canoe and thus hold firmly.

Laying Out a Tennis Court

By ROY BENHAM

ANY reasonably level vacant lot or other ground space, about 120 ft. long and half as wide, can be laid off into a tennis court, which will provide one of the best known forms of exercise, and certainly one of the most exciting games played in America.

If the ground is covered with grass of a good quality, this may be cut short,

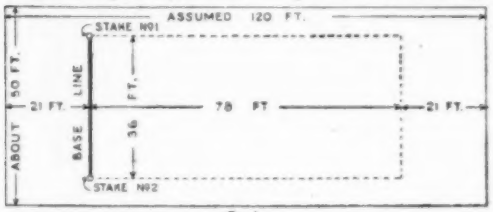


FIG. 1

Lay Out a Base Line 36 Feet Long, at Least 20 Feet from the End of the Lot

and a "grass court" formed. Such courts are sometimes preferred by beginners, but for the real game of tennis, all grass and weeds should be cleared from the ground, and may be kept off by the use of salt or some other chemical to prevent vegetation from growing. The dimensions of a tennis court are laid down in the official rules of the game, and the over-all dimensions are shown in Fig. 1. It thus appears that, on paper, the laying out of a tennis court is not a difficult proposition. But when one actually arrives on the ground and begins to locate the points of a court, it will be found that unless one is somewhat experienced in the work, the corners do not come out square and the lines do not all measure up as they should. There are, of course, many methods of going at the problem of laying out a court, but it is believed that the one here explained is as easy

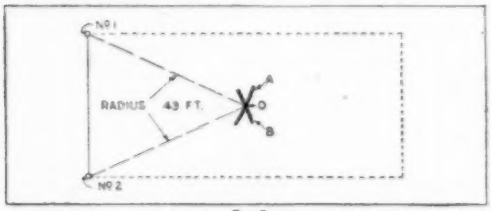


FIG. 2

Arcs Drawn at a 43-Foot Radius from the Ends of the Base Line Determine the Center of the Court

as any, and will enable any boy or girl to lay out a court in a few minutes. Some stout twine should be provided for measuring purposes, a tape measure several feet long, or a yardstick for laying out distances on this twine, 12 stakes for marking the corners of the court, two stout fence posts to hold the net, and material for the backstops, as described below.

Beyond the base lines, or lines at the extreme ends of the court, there should be a space not less than 20 ft.; 30 ft. is much better for a fast game. If it is found that 120 ft. of ground is available for the court, then by subtracting 78 from 120, we find that 42 ft. of ground will be available at the ends or 21 ft. between each base line and the backstop. Therefore, lay out a line 21 ft. from one end, 36 ft. long, to form the base line at this end of the ground, as shown in Fig. 1. This base line will be marked by two stakes, Nos. 1 and 2, 36 ft. apart, and the tape or whitewash line, whichever is to be used to mark the lines of the court, may be stretched at once between the two stakes, or this may be left till later, as preferred.

A length should now be measured off on a string, 43 ft. long, with nails tied in the string at both ends of the 43-ft. length. (The radius may be made 42 ft. 11⅜ in., if great accuracy is desired, but this is not ordinarily necessary.) First, drive one of the two nails in stake No. 1, as indicated in Fig. 2, and scratch with the other nail an arc A, near the center of the court. Transfer the fixed nail from stake No. 1 to stake No. 2, and scratch, in a similar manner, arc B. The intersection of the arcs A and B is the center of the court. Drive a temporary stake at this center, which we will call point O, and transfer the fixed nail to it from stake No. 2. Carry the other nail to the neighborhood of stake No. 3, seen in Fig. 3; hold the line taut and sight across stake O to stake No. 2. When the nail is in line with stakes O and No. 2, make a mark for stake No. 3. In a similar manner, locate stake No. 4, by sighting across stake O to stake No. 1.

Now swing the cord around to the position OC, about halfway between stakes Nos. 1 and 2. Holding the end C of the cord in the left hand, move the right hand up on the cord, toward the line 1-2. Swinging from right to left and back again, find the point on the cord which marks the shortest distance from O to the line 1-2, and tie into the cord at this point, D, the nail formerly tied at the 43-ft. point, C. The length of cord OD will then be 39 ft. This distance can of course be laid off directly from the yardstick or tape, if preferred. Next, with one of the two nails set in stake No. 1, scratch the arc E, and

similarly, from stake No. 2, draw arc F. It is best, before drawing these arcs, to draw the side lines of the court, 1-3 and 2-4. The arcs E and F will then be merely scratches across these lines, and a line joining them will pass through point O and will be the net line of the court. If two or more courts are being laid out side by side, all the base lines being in line with each other, it is not necessary to find points E and F by drawing arcs, as a line passing through all the center points O will be the net line for all the courts.

The principal work of laying out the court is now finished. As seen in the completed diagram, Fig. 4, a line from 3 to 4 will complete the outer boundary of the "double" court, and two other lines, 4½ ft. inside of the side lines 1-3 and 2-4 will form the boundaries of the "single" court.

Between these two single-court lines two service lines should be drawn at a distance of 18 ft. inside the base lines. Stakes, as indicated by Nos. 5, 6, 7, 8, 9, 10, 11, and 12, will be found very useful, although they would not be permitted to remain on a championship court; if the tape is torn, or marked lines obliterated by rain, they can be fixed again in a short time by using the stakes. If the stakes are used, they must not be allowed to project above ground; it is much better to have to hunt a few seconds for them after a rain has obliterated the markings, than to stumble over them during play. The backstops should be placed at the ends of the space, which was supposed in this case to be 120 ft. long, leaving 21 ft. at each end between the base line and the backstop. These backstops can be made from chicken netting and a few wooden posts. They should be from 10 to 20 ft. high, and 40 or 50 ft. wide, bending in towards the court at both ends.

Two heavy posts should be placed to take the ends of the net, 3 ft. beyond the

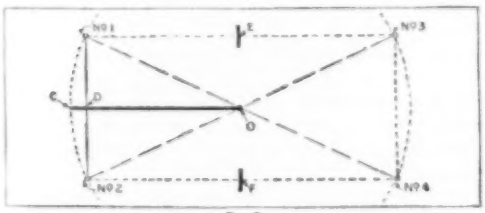


Fig. 3

The Other Two Corners of the Court are Located on a 43-Foot Circle from the Center

double-court boundaries on the net line. These posts should stand about 4 ft. high from the ground, and should be set in the ground firmly enough so that the net can be stretched very tightly between them. It is better to buy a net than to try to make one, as homemade nets will probably be found rather unsatisfactory.

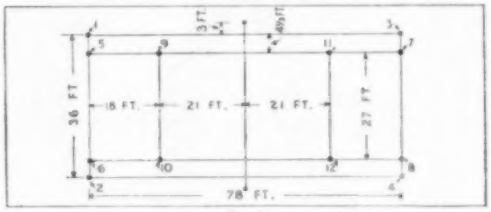


Fig. 4

The Completed Court will Have the Dimensions Laid Down in the Rules of Lawn Tennis

The net should be attached to the posts so that at the center, where it sags the most, its top is 3 ft. from the ground. At the sides of the court, it should be 6 in. higher than this. In attaching the net to the posts, it must be borne in mind that the net will stretch during the course of play, and at least until it becomes thoroughly stretched it must be adjusted every little while by tightening at the posts. A good way, therefore, is to have the rope through the top of the net long enough so that it can be merely wrapped around the top of the post several times, without being tied, and will be held by friction only. When the net becomes loose, it is only necessary to unwrap the ends of this rope from the post, pull it to the proper tightness, and again wrap it around the post.

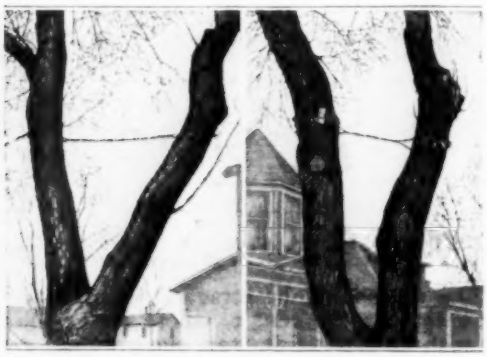
No attempt will be made here to tell how to play the game of tennis, as this is quite well known, and can be found in a great number of books. All players should provide themselves with copies of the official rules, which can be obtained at sporting-goods stores or hardware stores for a few cents. Only after one has become interested in the game, and acquired some little proficiency will he appreciate the advantage of a well laid-out and constructed court.

Kewpie Dolls Hold Talcum Powder

A novel holder for talcum powder is made from a kewpie doll by punching small holes with a pin in the doll's head, through which the powder is sprinkled. A larger hole is cut in the doll's back through which it is filled with powder. The hole for filling may be covered either with a piece of adhesive plaster or by a ribbon tied around the doll.—Mrs. A. Pearl McPherson, Flagstaff, Ariz.

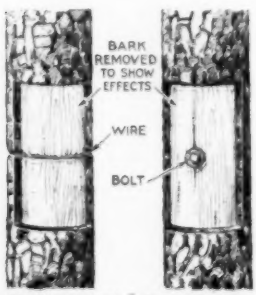
Bracing a Tree Limb

Frequently the symmetry of a tree can be preserved by properly bracing a limb that has been partly broken, or one that



At the Left, Right Way, and at the Right, Wrong Way of Tying Two Limbs Together

threatens to break off. Since the vital fluids of a tree circulate in and near to the cambium layer, which lies just underneath the bark, a wire or iron band around a trunk or branch tends to cut through the bark, and, finally, through this cambium layer, thus damming the flow of the sap in the tree. A bolt run through a limb or trunk pierces the cambium layer in only two small areas, which interferes with the movement of the sap to such a slight extent as to be entirely negligible. A snug-fitting bolt, with a washer for a bearing, will support the weight of a branch as well as a band encircling it. Connecting two bolts set in different branches will throw the weight of one branch onto the other, and still allow plenty of play for the swaying of the branches in the wind. Because of this swaying, wherever the distance is enough to allow for three or more links, a chain ought to be used. Sometimes conditions make it desirable to brace a limb by chaining it to two or more other limbs. A small block and tackle will make it possible to pull two branches together when putting the chain in place, so that when released to their natural position, the chain will be tight.

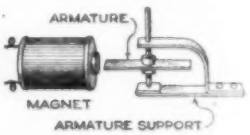


The photograph shows a repair made on a large ash, which was badly wrecked in a windstorm. Its location was such as to make it very desirable to save the tree, rather than wait until another had grown to take its place. The cleft at the fork, caused by the tearing apart of the large branches, extended down into the trunk. With block and tackle, the heavy branches were pulled back toward each other, and held securely in position while the work was going on. Two large bolts, placed through the trunk, brought the sides of the cleft together, and held the parts firmly in place. The wood, of course, was sound. A small groove was cut at the base of the cleft, so that any water that might tend to collect in the hollow would run off quickly. The two limbs were then chained together as shown. The tree, thus repaired, has since passed unharmed through a number of windstorms as severe as the one that wrecked it.

A Toy Synchronous Motor

A toy motor, which runs on alternating current from a small transformer, will give much pleasure to the boy who makes it. The speed of such a motor depends upon the rapidity at which the current alternates, since it is of the synchronous type, that is, of the type of motor which "keeps step" with the alternations of the current.

The armature, or moving part of this motor, is a piece of clock spring, or other hard steel, 2 in. long. A hole is punched exactly in the center for the shaft, which is a large needle. The armature is held tightly between two pencil erasers slipped over the ends of the needle. The armature support is made from sheet brass, or other nonmagnetic metal, bent to the shape shown in the sketch. A hole for the needle is drilled through the upper arm and through one thickness of the lower arm. A small, thin piece of glass is placed between the two thicknesses of metal, where the lower arm is folded over, for the needle point to rest on. This makes a very good bearing.



A magnet such as found on bells and buzzers may be used for the motor. It should be fastened to the motor base so that the center of the magnet core is a little above the level of the armature and about ⅛ in. from its end.

When the motor is assembled, turn on

the current. Then give the armature a whirl by spinning the needle between the thumb and finger. It may take several trials to learn just the proper speed required. After the motor once starts, it will run at a steady speed, unless too much load is put on it, or the current is cut off for an instant.

The only cause likely to interfere with the running of such a motor is that the magnetism of the coil might be so strong as to demagnetize the armature, rather than to turn it end for end. If the motor shows a tendency to run a while and then stop, use a weaker current, or separate the magnet farther from the armature.

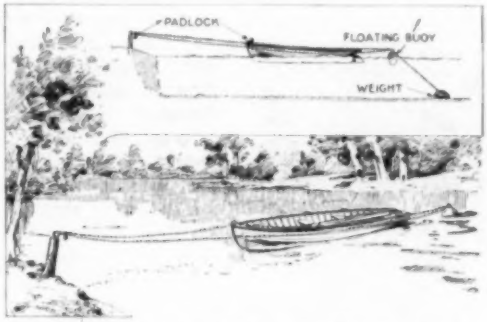
After considerable practice, the owner will learn to run the motor at any one of two or three different speeds by giving the armature the proper whirl in starting it. All of these speeds are in step with the alternations of the current.—H. J. D., Chicago, Ill.

To Photograph Fire Scenes

To photograph fire scenes in daylight is not a difficult task and there is no danger attached to the feat. A one-fiftieth of a second exposure at stop F.11 (U. S. 8) is sufficient at a distance of over 25 yd., provided the sun is shining on the subject. This will include all smoke clouds and details back of the scene. No smoke should come between the camera lens and subject. Without direct sun, use about one-twenty-fifth of a second at stop F.8 (U. S. 4). A huge conflagration in the night, while awe-inspiring and weird, does not lend itself readily to photography, and a silhouette picture of the flame itself, outlined against the blackness of the night, is the only thing possible, with one-twenty-fifth of a second exposure at stop 16—the largest stop on a fixed-focus, or box camera. The latter rule applies to all snapshots of fire scenes with fixed-focus cameras.

Mooring and Locking a Boat Away from Shore

The sketch shows a method of mooring and locking a boat at a safe distance from the shore. A post is driven into the ground on shore and fitted at the top with a large iron ring. At some distance from the shore, a floating buoy is anchored with a chain to a rock which rests on the bottom. This buoy has a short post fitted with a large iron ring, similar to that on the other post. A length of chain is threaded through both rings, and the ends fastened firmly together, thus forming an endless chain through the two rings. A

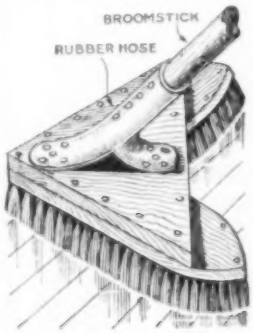


A Boat Moored and Locked at a Distance from the Shore cannot be Readily Stolen

third iron ring is fastened to the bow of the boat. Two padlocks will be required. When landing from the boat, fasten any link of the chain, with one of the padlocks, to the ring on the bow of the boat; then pull on the chain so as to move the boat away from shore and near the floating buoy. Then fasten the other padlock through the ring on the shore post and also through a link of the chain, so as to lock the chain at that end. The boat is thus held away from the shore, and cannot be pulled in until the padlock is removed.

A Flexible-Handle Scrubbing Brush

Many backaches may be saved by furnishing the housewife with a flexible-handle scrubbing brush, which will reach into corners, the combination making it unnecessary to stoop, or to go down on the knees, thus taking a great deal of hardship out of her day's work. Two hand-scrubbing brushes cut to fit together at an angle, a little more acute than a right angle, are screwed to a three-cornered piece of ½-in. wood. A broomstick handle is slipped into a short piece of hose, which is split at the other end, and fastened to the triangular piece, and to the handle, with tacks. The result is a flexible brush that will make a hard task much easier.

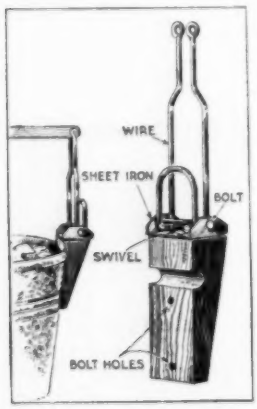


A Homemade Washing Machine

A very good washing machine can be made from an ordinary washtub, and a

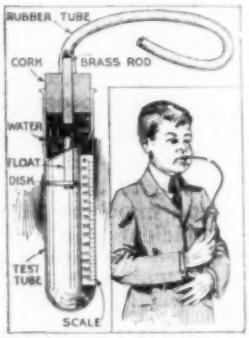
washer of the type which resembles an inverted funnel on a long handle. A hardwood handle is made, 1½ by 2½ in. by 3 ft. A 3/16-in. hole is drilled in this, 1 ft. from the end, and a heavy strap of galvanized iron, having a 3/16-in. hole in the center, is bolted to the stick so that the two holes are in line with each other. Several 3/16-in. holes, bored on the handle of the washer, will make it possible to adjust its height as required. A piece of sheet iron is cut and drilled as shown in the sketch, and is fastened by a screw, at its center, to the top of a small tapered hardwood block, so that it will turn easily. The washer can thus be turned to reach all parts of the tub. The ends of the sheet-iron strip are bent up, and a small bolt inserted in the holes. The block is then bolted to the edge of the tub. A piece of heavy wire, bent as shown in the drawing, is bolted to the end of the 3-ft. stick, and hooks under the bolt on the swivel block.

With the tub about two-thirds full of clothes and hot soapy water, the hardwood handle is worked up and down, while the handle of the washer is held to guide it to all parts of the tub. Every part of the tub can be reached, and the clothes thoroughly washed by having the hot soapy water forced through them. The handle may be adjusted, so that a person of almost any height can use the washing machine without having to bend over the work. The machine can be taken apart by merely unhooking the wire from the bolt on the swivel block, and taking out the bolt that holds the washer under the strap on the hardwood handle. In this way, it can be easily stored away in a very little space. It is easily made, easily used, and costs very little.—E. K. Wehry, Cedar Rapids, Ia.



A Trick Breath Tester

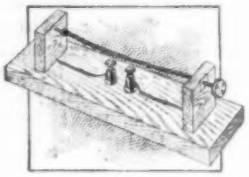
A great deal of fun can be had by the owner of a trick breath tester. The instrument consists of a large test tube filled with water. In this is placed a smaller closed-end tube, which is inverted and slipped into the large tube, thus leaving enough air in the upper end of the small tube to float it in the water of the large tube. It is kept in the center of the large tube by a pasteboard disk, soaked in melted paraffin or candle wax, and fastened around the bottom of the small tube with some of the wax. Holes cut in this disk enable the water to pass through it when the float moves up and down. The large test tube is closed by a cork, through which a short length of glass rod has been passed. This rod forms a "fake" tube, and over it is slipped the rubber tube, through which the victim is to blow. When the cork is put into the large tube, the buoyancy of the small tube can be regulated by putting the cork in tightly or pulling it out somewhat, as necessary. It should be so adjusted that, when the sides of the large tube are pressed, the small tube, or float, will sink to the bottom of the large tube. When the cork has been so adjusted, it should be sealed in place with thick shellac or sealing wax. To complete the deceptive appearance of the tester, a paper scale should be made and pasted to the outside of the tube. When the victim is asked to test his breath, he blows into the rubber tube as hard as possible, but, in spite of his exertions, the float remains stationary at the top of the scale. The owner then takes the tester, and while apparently using it in the same manner as his victim, gently presses the side of the larger test tube, at the same time blowing into the rubber tube. This causes the float to sink



to the bottom of the scale, to the surprise of the victim, who does not know of the fact that the other person is using pressure on the tube.

A Simple Chain Rheostat

The rheostat shown in the sketch is based on the effect of tension between the links on the passage of electrical currents. By tightening the chain, more current will flow, and by loosening it the flow is reduced. The device is useful for reducing current in small electrical apparatus.



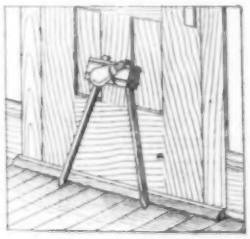
The chain is mounted between a hook and a nut which works on an adjustable thumbscrew set into a small brass plate. It is about 6 in. long, and the hook and thumbscrew are connected to binding posts on the base.—William Warnecke, Jr., New York City.

Lawn Scraper Made from a Rake and a Barrel Stave

A scraper for grading lawns is quickly made by wedging a barrel stave between the end teeth of a garden rake. When needed at short notice, or for a few minutes only, this will provide an efficient scraper.

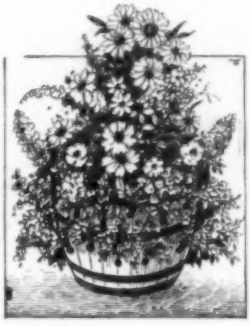
Breaking Lamp Bulb Warns of Burglar

A very efficient burglar alarm can be made from a burned-out electric-light bulb, because of the noise it makes when broken. Fasten two legs to a brick, and lean it against the door. Tie the light bulb to the side of the brick. When the door is opened the brick falls over on the bulb, breaking it, frightening the invader, and arousing the household. Care should be taken to have the legs far enough apart at the bottom so that the brick will not fall over on a side other than that to which the bulb is fastened.—Leon D. Gray, E. St. Louis, Illinois.



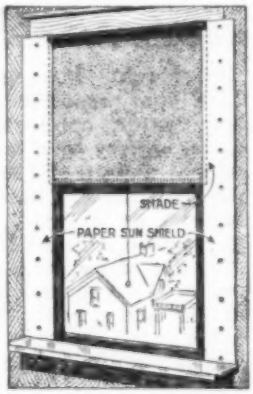
A Spreading Flower Box

A flower box with the side covered by vines presents an attractive appearance. Such a box is easily made by boring large holes in the side of the box and planting vines in the dirt inside of these holes, taking care to leave the foliage all on the outside while setting the roots deep into the soil. If planted with Vinca or Wandering Jew vines, which grow very rapidly, the box will be entirely hidden in a very short time.—C. A. Black, Jr., Hightstown, N. J.



Shade Eliminates Annoying Sunbeams from Workroom

In the early morning and toward evening, much trouble is experienced in drafting rooms and workshops from the direct rays of the sun shining upon the bench or drafting table. With the ordinary type of window shade, the trouble cannot be eliminated entirely, as there are spaces at the side of the window through which narrow beams of light come in, and these are particularly troublesome. In one drafting room this trouble was entirely eliminated by tacking strips of stiff paper on the window casing at both sides, so that the shade is kept from blowing inward and, at the same time, the light which might come past the edges of the shade is completely cut off. In the case of double windows, one wide strip between the two windows will take the place of two strips. The hint is a valuable one also in laying out plans for new drafting rooms or shops, as a construction similar to this could easily be provided in order to avoid permanently the trouble from direct sunlight.



Trees Form Battery and Ground in Novel Telephone Line

A telephone which can be used by hunters, campers, or surveying parties, and which has unusual features, is shown in

A Practical Telephone for Use in the Woods Receives Current from a Battery Made by Driving Copper and Zinc Pins into Trees at Each End of the Line

the sketch. It consists of an ordinary 1,000-ohm receiver and a microphone transmitter, connected in series with a novel battery by a copper wire. The battery is a part of the ground circuit, and its elements are nothing more than two metal pins or rods, one copper and the other zinc. One of these pins is driven into a tree at each end of the line, and both are connected in series with the receiver and transmitter by copper wire. Sufficient current to operate the receiver and transmitter is obtained from the battery, formed of these two unlike metals and the sap of the trees into which the pins are driven. When so desired, the outfit may be used as a telegraph, the make and break of the key being heard in the telephone receivers. Since it is possible to extend the one wire by merely looping it over boughs of the trees, this telephone system may be used over quite an extensive territory—Frank Sahlmann, Manhattan, Kan.

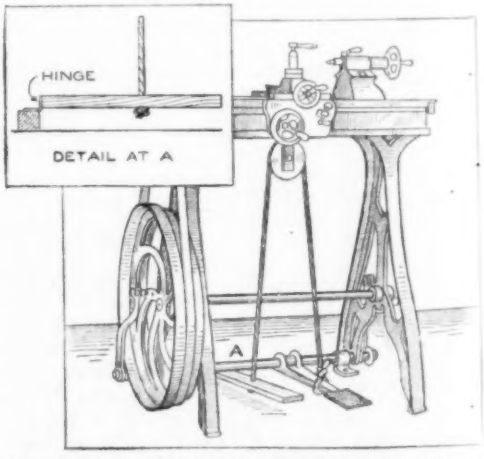
¶ Where gasoline lines on cars are likely to chafe, wrap a piece of inner-tube rubber around the tube several times, and fasten with wire.

Preserving Shoe Soles with Copal Varnish

Shoe soles may be made to wear for longer periods without repair being necessary, if they are given a coat of varnish before wearing, and again at intervals of from two weeks to a month. Varnish made of copal has been found very satisfactory. The varnishing is a great deal cheaper than having the shoes resoled, and serves to put off the need of such a repair for some time. New shoes should be treated after having been worn a day or two. The best way is to apply the varnish at night, so that the shoes may be worn the next day.—William T. Grinstead, Columbia, Mo.

Improving a Foot-Power Lathe

Many foot-power lathes have only one pedal, giving one impulse to each revolution of the driving wheel. This can easily be improved by adding another pedal, as shown in the sketch. A pulley is fastened underneath the lathe bed, directly above the regular pedal and the one to be added. The new pedal may be a piece of hard wood, 3 in. wide by 1 in. thick, and as long as the original one. It is fastened at the back of the lathe, to a hinge on a block which has been screwed to the floor. A strong, lightweight rope is then fastened to the new pedal, strung over the pulley, and brought



The Addition of an Extra Pedal to a Foot-Power Lathe Provides for Two Power Impulses per Revolution Instead of the One

down to the iron pedal and fastened. The iron pedal should be in a position halfway between the extreme upper and

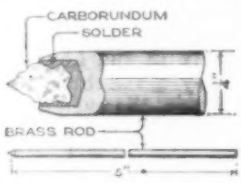
the lower point, while the wooden one is at the same height. This addition gives a walking motion to the operation, the same as the two-crank foot-power machines have.—Edwin J. Backman, Fullerton, Pa.

Broom Stiffened with Piece from Inner Tube

Brooms, especially the cheaper grades, give trouble by spreading out and thus becoming useless. They may be made stiffer by forcing a wide band, cut from a rubber inner tube, over the upper part of the straw. This may be slipped up or down to suit the requirements of the work, making the broom stiff or not, as necessary.

A Tool for Scratching Glass

A very serviceable cutting, or scratching, tool for glass can be made in the following manner: Cut a rod of iron or brass, about ¼ in. in diameter, to a length of about 5 in. File one end flat, and drill a hole in the end, somewhat less than the diameter of the rod, and of a depth about equal to the diameter. Then procure some carborundum crystals, such as are used in wireless-telegraph detectors, and break off a chip which will fit into this hole, with a sharp point or edge projecting. Hold it in place with pliers, and run hot solder all around it, so that it is firmly imbedded and held fast to the rod. By properly selecting a good cutting edge, this tool will work very well for making graduations and marks on glass.



To Carry Water without Spilling

When water is carried in an open pail, tub, or barrel, it has an unpleasant way of slopping over, often drenching the person carrying it, or, if it is being transported in a wagon, it splashes over the occupants of the vehicle. One remedy is to cut a piece of burlap, or gunny sacking, to about the size of the pail or barrel top, and place it on the surface of the water. This method reduces the surface disturbance to a minimum, thus preventing much discomfort. It is especially useful when the pail has no cover.—J. T. Bartlett, Ft. Collins, Colo.

Auxiliary Mirror Aids in Shaving

Shaving in a room where the light is on one side of the mirror is difficult, because, while one side of the face is brightly illuminated, the other is shaded. A small mirror, placed as shown in the sketch, will reflect light to the shaded side of the face, making it as easy to shave that side as the other.

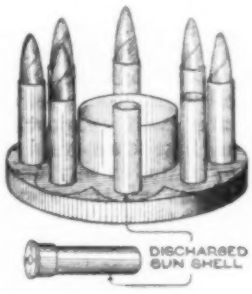
A Small Mirror may be Used to Reflect Light onto the Shaded Side of the Face

Drop-Cord Shortener

Various devices are in use for fastening the cord of a hanging incandescent lamp so as to adjust its height. One of the simplest ways of doing this is to slip a loop of the cord through a short length of small fiber tubing, of the right diameter to give enough friction to hold the lamp in position.

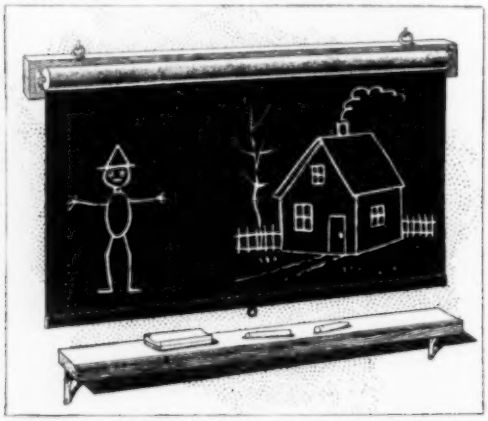
Cigar Stand for Gun Club

A member of a gun club may provide a cigar stand for himself and friends by utilizing a number of discharged No. 12 gauge shotgun shells. These are fastened with glue, open ends up, in holes bored around the circumference of a suitably sized board. A metal ash tray may be fastened in the center of the board, and the whole stand given a coat of shellac or varnish. If desired, the bottom of the stand may be covered with felt.



Using Old Window Shade as a Blackboard

A blackboard that is out of the way when not in use, and which can be at service instantly when wanted, is made by



Children need Not Be without Blackboards as Long as Dark-Colored Window Shades can be Obtained

hanging an old, dark-green window shade from the molding in the children's room. This color serves as well as the black of a regular blackboard, and the material is easily cleaned with an eraser. The shade can be hung either from a piece of wood to which the fixtures have been fastened, or from the molding. When not in use, the "blackboard" can be rolled up. The advantage of having the roller attached to the piece of wood is that screw eyes can be fastened into it, and the blackboard hung up anywhere from hooks or nails in the wall.—Charles A. Goddard, Los Angeles, Calif.

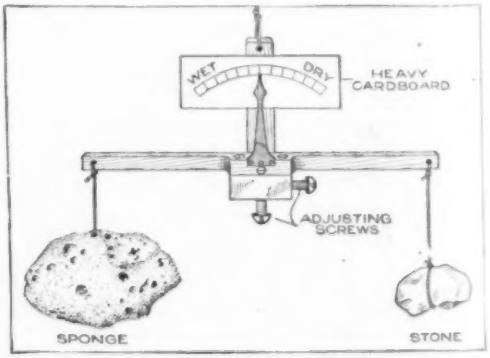
A Simple Weather Indicator

The weather indicator shown in the sketch is of very simple construction, but if carefully made, it is capable of great accuracy. In principle it is what is known as a hygrometer; that is, it tells whether the air contains as much moisture as it will hold, or whether it is so dry that water will evaporate quite rapidly. In the first case, rain may be expected at any time, as any chill through the upper regions of the atmosphere might cause the water vapor to collect and fall as rain. If, on the contrary, the air is quite dry, a similar change of temperature will not produce rain.

The short vertical stick, shown suspended from a string, may be held either in this manner, or attached to a wall. The crossbeam is fastened to it with a small screw or brad, on which it should turn quite freely. From the hole in the left end of the beam is hung a sponge, which has been soaked in very salty water and then allowed to dry without squeezing the water out of it. The salt remains distributed in a finely divided deposit throughout the sponge. In wet weather, this salt will take up from the atmosphere enough moisture to cause a slight difference in the weight of the sponge, and when the air becomes dry, some of this moisture will again evaporate into the air. It is by showing these changes in the weight of the sponge that this instrument indicates the condition of the atmosphere.

From the other end of the beam is hung a pebble or small piece of iron, which is almost of the same weight as the sponge. As it will be difficult to make this weight exactly equal to the sponge to be balanced, a horizontal adjusting screw may be placed in a block mounted just below the center of the beam, to provide accurate adjustment. This screw should work quite freely in the hole, so that it can be turned by a touch of the fingers. By unscrewing it, the weight is thrown slightly to the right, which has the effect of making the pebble side heavy; screwing it inward makes the weight of the right side slightly less.

The hole in the center of the beam, in which is placed the pivot nail or screw, should be drilled slightly below a straight line connecting the two holes at the end. Then the beam will not rest in a level position, even if the weights at its ends are perfectly balanced, but will tilt one way or the other. This condition is reversed by the addition of the block which holds the adjusting screws.



The Tendency of Finely Divided Salt to Absorb a Slight Amount of Moisture is Taken Advantage of in Constructing This Hygrometer

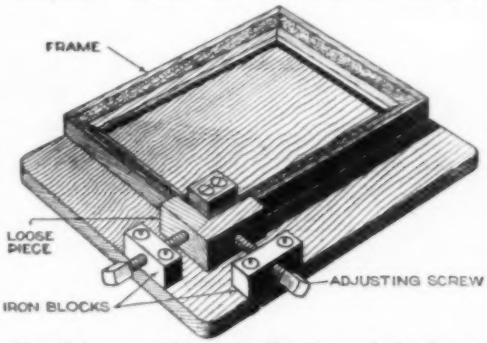
The pointer attached to the beam may be cut out from pasteboard, or from a piece of a tin can. A card, tacked onto the stick, will make it easier to observe the movement of the pointer, and the space over which it moves may be divided off into equal lengths. The word "wet" is placed on the same side as the sponge, and the word "dry" on the other side. In adjusting the hygrometer to a perfect balance, use is made of two heavy screws as weights, placed one in the side and one in the bottom of the block. The horizontal screw should be turned until there is no tendency of the beam to revolve more in one direction than in the other; the vertical screw should then be set to hold it this way normally and yet allow it to move with the required degree of sensitiveness. This adjustment should be made on an average day, when the air is neither very wet nor very dry. Observation of it can be made from time to time, and marks placed on the card, showing the farthest points reached on both sides over a period covering both wet and dry weather. If the pointer goes off the scale, unscrew the vertical adjusting screw slightly. If it does not move much, set this screw farther in. After gradually getting the instrument into proper adjustment, it will give interesting and quite reliable information, as to the amount of moisture in the air, or what is called by the weather man the "relative humidity." —S. Leonard Bastin, Bournemouth, Eng.

Using Coins as Weights

In an emergency, coins can be used as weights. The weights, as given below, are near enough for most practical purposes, the error being not over 3½ per cent from the weights given. A dime weighs 40 grains; a cent, 50; a nickel, 80; a quarter, 100; a half-dollar, 200, and dollar, 400 grains. By addition and subtraction of these known weights, it is possible to get almost any combination. For example, to weigh 20 grains of a chemical, place a quarter in one pan of the scales, and a nickel in the other, then add enough of the chemical to the pan containing the nickel to balance the scales.

Clamp for Picture Framing

A convenient way to hold molding, while it is being glued to form a picture frame, is to fasten on a flat board three blocks, as shown, by means of two screws in each. Working in two of these blocks are setscrews, as shown, these coming against a right angle block, not fastened, which in turn clamps the molding against the block inside of the frame. The blocks between which the molding is clamped



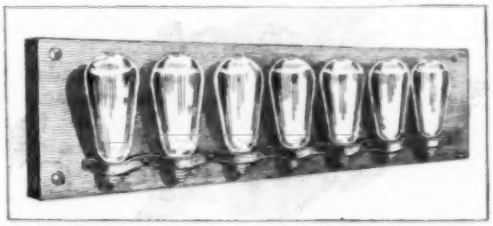
Two Setscrews Clamp the Members of the Picture Frame to Each Other, and Hold Them at a Right Angle

should be carefully squared, and a quite accurate job will result.—J. H. Moore, Hamilton, Ont., Can.

Lamp Bulbs Used as Fire Extinguishers

Cheap fire extinguishers for the workshop or laboratory can be made of a number of old burnt-out electric lamp globes. The lamps are placed in a rack, such as the one illustrated, after being filled with water, or better, with some solution having special fire-extinguishing properties. One such solution can be made by taking 20 parts calcium chloride, 5 parts of common salt, and 75 parts of water. The globes are filled by immersing them in a pail containing the solution, and breaking off the tips with a pair of pliers. They will fill quickly, owing to the fact that the air has been largely exhausted from them during manufacture.

When a fire occurs, one or two of these globes are thrown at the burning object.

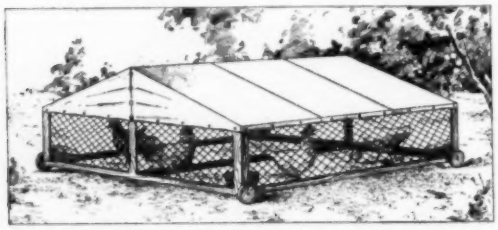


Burnt-Out Lamp Globes Filled with Fire-Extinguishing Solution will Reduce the Fire Risk in the Laboratory

The solution will spatter over it, extinguishing the fire.—Elmer W. Schaller, Mendota, Ill.

Chickens Act as Lawn Mower

The movable coop shown in the sketch is used to confine a small flock of chickens to a portion of the lawn until they eat



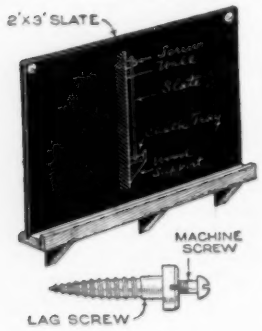
A Movable Chicken Coop may be Pushed about the Lawn So That the Grass will be Eaten Off Uniformly

the grass down to the desired length. The coop is then moved to a new location. Repeating this process keeps the lawn trimmed, and provides the chickens with green food. The coop is a light wooden frame made of panels joined at the corners with iron brackets. Wire netting is used to cover the sides, and the top is roofed with 8-oz. cotton duck, which sheds rain and protects the chickens from the heat. Four small wooden wheels, attached with bolts at the corners, make it possible to push the coop about easily. Drinking fountains are attached to two corners and food hoppers at the other two corners.

Filling a Fountain Pen with a Match

When filling an old-fashioned fountain pen which is not provided with the self-filling mechanism, in the absence of a glass pen filler, a good substitute is a match or small stick of wood. If dipped into the ink and held so that the ink drops into the holder of the fountain pen, the operation, although not quite so rapid as with the filler, will be clean and satisfactory.

A Wall Stud Made from Two Screws



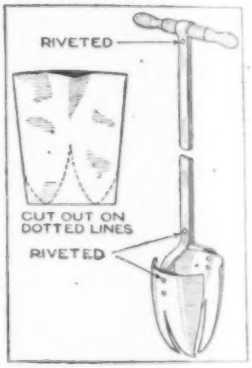
A stud made of a machine screw fitted into the head of a lag screw, which has been drilled and tapped for it, is useful for fastening a blackboard or other article firmly to a wall of plaster, wood, or brick.

To Save Printing Paper

When buying printing paper for a small camera, considerable money can be saved by buying paper in the larger sizes and cutting it to size with a knife. For instance, for pictures 3¼ by 2¼ in., get paper 3¼ by 5½ in. and cut it in two, or for pictures 2½ by 4¼ in., get 5 by 7-in. paper, and three full-size prints can be made from each sheet. If much printing is done, this saving counts up to quite important sums.—Fred C. Davis, St. Joseph, Mo.

A Post-Hole Digger Made from Two Shovels

A post-hole digger, or auger, made from two old shovels and a piece of heavy strap iron, will enable one or two men to dig a post hole by merely revolving the tool with some downward pressure. The two shovel blades are cut and fastened as shown, the blades being bent so that they cut off a slice of earth as they revolve in the hole. The tool is especially useful in clay or soil which is not full of stones; if many of these are present, the tool must be made quite strong and heavy.



Ice Water Used to Prevent Photographic Halation

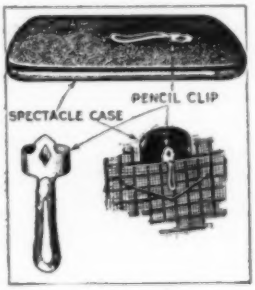
While in service as a military photographer in the United States Army I was assigned to take a picture of a group of loving cups which were to be awarded as tokens of appreciation for distinguished service by regiments overseas. Because of the high polish of the cups, two photographers, previously sent out on the job, had failed to take a satisfactory picture. All they had produced was an image of the glaring reflection of the light as it was hurled from the subject.

I realized that, to get a picture, some method of reducing the reflected light would have to be worked out, so proceeded to fill the cups with ice water. Soon the outside surface of the metal began to "sweat" and instead of the glistening silver which refused to record

properly on a photographic plate, the cups had a dull finish which absorbed rather than reflected the light. Proceeding with my exposure, I obtained a perfect picture, much to the surprise of my commanding officer, who admitted that the ice-water idea had never occurred to him, and that he could think of no way of effectively overcoming the halation.—John Edwin Hogg, Alhambra, Calif.

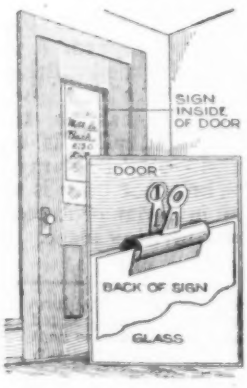
Clip Prevents Losing Spectacles

Persons who wear glasses part of the time only, often experience the trouble of losing the cases in which they are carried when not in use. An ordinary pencil clip, fastened to the case, will usually prevent this loss. The wings of the clip which fit around the pencil are spread slightly and inserted in slits cut in the covering of the case. As the clip is pushed down against the case, the wings flatten out entirely to fit against the metal. While the clip will hold in most cases in this way, it should be riveted through the metal for best results.



A still safer way of carrying the spectacle case, which is also applicable to the fountain pen or pencil, is to fasten a safety pin inside of the pocket, and clip the case or pen to the pin. In this way, the object is kept entirely inside the pocket, but firmly fastened by the clip.—A. E. Kipps, Hamilton, Ont., Can.

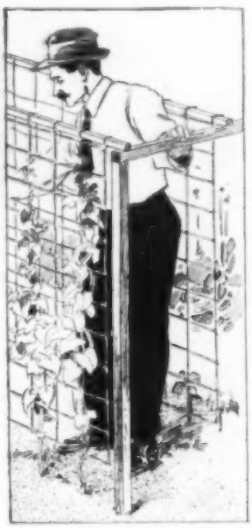
Sign Holder for Glass Store Door



Posters and price lists, usually gummed to windows or jammed under the woodwork, are easier to hang, and are held more firmly, when suspended from large paper clips, screwed to the door frame. They can be quickly changed, and are not easily spoiled.

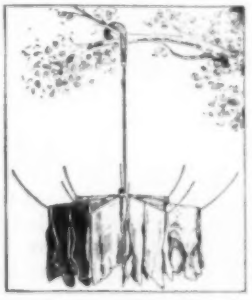
Arbor of Woven-Wire Fencing Supports Pole Beans

In a garden where space is at a premium, as it is in the city, a place to plant pole beans or other crops which require a great deal of room, is difficult to find. The arbor shown in the drawing solves the problem in many cases. It consists of a light wooden framework upon which woven-wire fencing is stretched. End pieces of 2 by 4-in. lumber are driven into the ground at each end of the row. Pieces of 2 by 2-in. lumber are nailed to the 2 by 4-in. pieces at the top. The netting is supported by 2 by 2-in. pieces extending along the rows and resting on the crosspieces nailed to the stakes. It is not necessary to tack the wire to the horizontals or to the stakes; merely twisting it around the 2 by 2-in. strips will hold it in place with somewhat greater strength than would be secured by tacking it.—Roy H. Poston, Flat River, Mo.

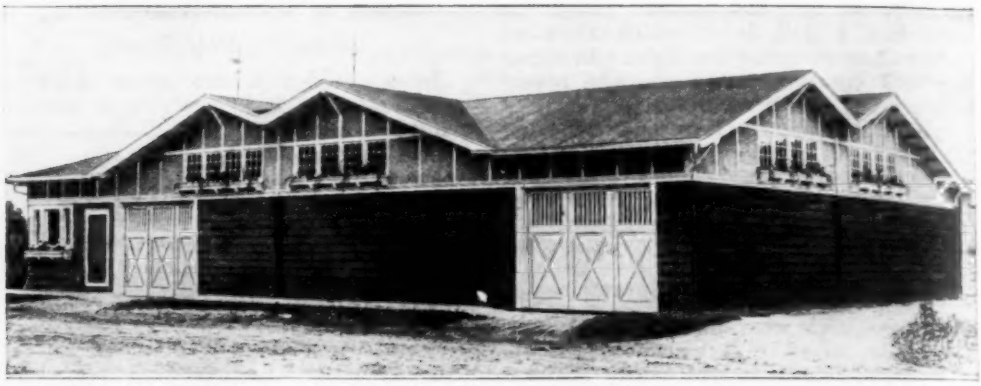


Clothes Rack Made from Umbrella

An umbrella which has seen its last days of usefulness as a protection from rain, may still be very useful to its owner. Rip off the cover and clean the frame, taking special pains to remove all traces of rust. Then enamel the frame, using preferably a white, glossy enamel. This is to prevent further rusting. The umbrella, changed in this way, may be inverted, and used as a drying rack for small articles, such as collars and handkerchiefs. It may be hung either indoors or out, depending on the weather.



MODEL LUMBER YARD IS COMMUNITY ASSET



The Owner of This Attractive Lumber Yard Believes the Building-Material Merchant should Set a Good Example in His Community. As Compared with the Average Establishment, This One Presents a Remarkably Inviting Appearance

IT is uncommon to find a retail lumber merchant who appreciates the value of having a place of business that is pleasing and inviting in appearance. Yet in one town at least, there is a building-material establishment that may be called both attractive and artistic.

The establishment in question is situated in a small Minnesota town. It consists of a two-story structure, 85 by 98 ft. in ground dimensions, that serves as warehouse and office. Instead of being a mere shed covered with red barn paint, it is a frame and stucco building, not greatly unlike a bungalow in design. The lower part of the structure is finished in red-wood siding, stained a rich brown, while the upper part is of paneled stucco, with long flower boxes 6ft. with growing plants installed before groups of small-paned windows. The exterior trim is white, while the roof, with overhanging eaves, is gabled and low like that of a cottage.

Showing the Interior Arrangement of the Unusual Structure, Which Contains Office, Warehouse, and Storage Yard

The office occupies one corner of the building, the remainder of which is utilized as a warehouse and storage yard. A U-shaped driveway that gives access to the material stores and lumber piles is cemented throughout and closed by garage-type sliding doors. Thus, not only is all the lumber and other material protected, but it is kept in a clean, inviting place.

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